PROJECT MANUAL

Including specifications

for the construction of the

BRADY ISD

BOND 2018 PROJECTS

1003 West 11th Street
Brady, TX 76825

1306 Barrington Dr. | Austin, Texas 78753 | (512) 758-7660

Date Issued: 4/4/2019.

PROJECT MANUAL

including

SPECIFICATIONS

for the construction of the

BRADY ISD
BOND 2018 PROJECTS
1003 West 11th Street, Brady, TX 76825
325-597-2301

Prepared by:

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1306 Barrington Dr. | Austin, Texas 78753 | (512) 758-7660
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Consultants:

Hendrix Consulting Engineers
115 E. Main, Round Rock, Texas 78664
512-218-0060

Gil Engineering Consultants
506 E Braker Lane, Austin, Texas 78753
512-853-4203

LOC Structural Division
1707B Kinney Ave; Austin, TX 78704
512-499-0908

Counihan and Associates
13132 Kellies Farm Lane; Austin, Texas 78727
512-388-4665

True North Consulting Group
13284 Pond Springs Road, Suite 304, Austin, Texas 78729
512-451-5445

Construction Manager Agent:

DSA Construction Management
207 North Ridgeway, Cleburne, TX 76033
817-645-8864

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4/4/2019

DIVISION 00 – PROJECT PROCUREMENT AND CONTRACTING REQUIREMENTS

00 11 19 - REQUEST FOR PROPOSAL

Separate sealed proposals, addressed to Duane Limbaugh, Superintendent, Brady Independent School District, 1003 West 11th Street, Brady, Texas 76825, are being received for **Bond 2018 Projects** Proposals will be received until **5:00 p.m..** on **May 13, 2019** at DSA"s Office and received until **2:00 p.m.** on **May 14, 2019** at the Office of the Superintendent at which time the proposals will be opened and read publicly in the Brady I.S.D. Board Room at Brady, Texas. All inquiries should be directed to the Construction Manager, Attention – Barry Foil, Project Manager.

D.S.A., Inc. Construction Management
207 N. Ridgeway, P.O. Box 702
Cleburne, Texas 76033
Phone 817/645-8864

Proposals received after **2:00 p.m..** closing time will be returned unopened. Separate contracts and purchase orders will be awarded for the various disciplines of work required. Time on this project is of the utmost importance. Each proposal will be considered based on price (30%), contractor's reputation (30%), time schedule (15%), ability to man the project (10%), experience (10%), and quality of contractor's goods or services on each portion of work to be completed (5%). The awarding of proposals will not be made at this time.

Bid Security, if bid is greater than $25,000, in the form of a surety bond executed by a surety company authorized to do business in the State of Texas in the amount of 5% of the total Bid must accompany each Bid in accordance in the Instruction to Bidders.

Payment and Performance Bond shall be as follows:

> For a contract price of $25,000 or more, the Contractor will furnish a Payment bond and a Performance Bond of not less than one hundred (100%) percent of the contract price, conditioned upon the faithful performance of the contract and upon payment of all persons supplying the labor or furnishing the materials used on this project. Cost of the bonds shall be paid by the Contractor.

The Owner reserves the right to waive any formalities or to reject any or all proposals. No proposals may be withdrawn until the expiration of 30 days from the date proposals are opened.

Sealed Proposals:

Brady Independent School District
Duane Limbaugh, Superintendent
1003 West 11th Street
Brady, TX 76825

Note: A pre-bid meeting is set for April 22, 2019 at 1:00 p.m. at the Brady ISD Elementary School.

00 22 17 - CONSTRUCTION MANAGER'S INSTRUCTIONS FOR PROPOSALS

PROPOSAL METHOD:

For information concerning plans and specifications, and for any other information or instructions concerning the proposal procedures, please contact:

Barry Foil, Project Manager
D.S.A., Inc. Construction Management
207 N. Ridgeway, P.O. Box 702
Cleburne, Texas 76033
817/645-8864

Sealed proposals should be submitted before the proposal closing time to Duane Limbaugh, Superintendent, Brady Independent School District,1003 West 11th Street, Brady, Texas, 76825.

Proposals for a Bond 2018 Projects will be received until 5:00 p.m. May 13, 2019 at DSA's Office and received until **2:00 p.m., May 14, 2019** at the Office of the Brady I.S.D. Superintendent, 1003 West 11th Street, Brady, Texas 76825 at which time the proposals will be opened and read publicly in the Brady I.S.D. Board Room at Brady, Texas.

All proposals submitted shall be identified on the front of the enclosure as to what category of work being proposed.

CONSTRUCTION METHOD:

Construction work on this project shall be contracted for and performed under a system of construction management wherein the Owner contracts directly with various Prime Contractors for performance of various portions of work.

All contracts and purchase orders will be prepared by the Construction Manager for the account of and signature of the Owner.

Payments to Contractors and Suppliers will be prepared and processed by the Construction Manager after the work, and materials have been approved by the Construction Manager, with Owner's check payable direct to the Contractors and/or Suppliers.
Payment and Performance Bond shall be as follows:

> For contract price of $25,000.00 or more the Contractor will furnish a Payment Bond and a Performance Bond of not less than one hundred (100) percent of the contract price, conditioned upon the faithful performance of the contract and upon payment of all persons supplying the labor or furnishing the materials used on this project. Cost of the bond shall be paid by the Contractor.

The Owner reserves the right to waive any formalities or to reject any or all proposals. No proposals may be withdrawn until the expiration of 30 days from date proposals are opened. Proposal prices will be accepted according to price of equal work and materials, the ability of the Contractor to man the project and complete the project, as time is very important to meeting time schedules of the Owner.

00 42 26 - PROPOSAL FORM: CONSTRUCTION MANAGEMENT, MULTIPLE-PRIME CONTRACT

The undersigned, having carefully examined the Construction Documents (the Plans, Specs, Addenda), all related material & the proposed project site, hereby propose to furnish all materials, labor, tools & equipment to complete this project in full accordance to the Contract Documents within the time limits & price as follows.

BASE BID:

_____dollars($_____.00).

BID ALTERNATES:

1. PROVIDE ADDITIONAL ACCESS CONTROLS AND CAMERAS, RE: TECHNOLOGY
(add / deduct) _____dollars($_____.00).

2. PROVIDE STAINLESS STEEL COUNTERTOPS AND SPLASHES IN LIEU OF PLASTIC LAMINATE CLAD COUNTERTOPS AT CLASSROOM C113.
(add / deduct) _____dollars($_____.00).

3. PROVIDE CHAIR RAIL & WAINSCOT AND PROVIDE LVT IN LIEU OF VCT AT CLASSROOM C113.
(add / deduct) _____dollars($_____.00).

4. REMOVE EXISTING AND PROVIDE NEW PARTITIONS (06M) BETWEEN CLASSROOMS AT ELEMENTARY RENOVATIONS.
(add / deduct) _____dollars($_____.00).

5. REMOVE EXISTING AND PROVIDE NEW WALL TILE AT ELEMENTARY CORRIDORS (AT ALL PARTITIONS EXCEPT INNER CORE).
(add / deduct) _____dollars($_____.00).

6. REPLACE E201 FRAME AND DOORS, AND WINDOW 'D' AS SHOWN.
(add / deduct) _____dollars($_____.00).

UNIT PRICING:

1. IP CAMERA, RE: TECHNOLOGY. _____ dollars ($_____.00) per unit.

We propose to complete the work within _____ consecutive calendar days after Notice to Proceed, per the General Conditions.

We acknowledge receipt of the following Addenda: _____.

By the act of submitting a bid for the proposed contract, the Bidder represents that:

2. The Bidder and all subcontractors the Bidder intends to use have carefully and thoroughly reviewed the drawings, specifications and other construction documents and have found them complete and free from ambiguities and sufficient for the purpose intended.

3. Discrepancies not brought to the Architect's attention prior to acceptance of bids have been bid in the more costly manner as may be determined by the Architect.

4. The Bidder and all workers, employees and subcontractors the Bidder intends to use are skilled and experienced in the type of construction represented by the construction contract documents.

5. The bid figure is based solely upon the construction contract documents and properly issued written addenda and not upon any other written representation.

6. Neither the Bidder nor any of his employees, agents, intended suppliers or subcontractors have relied upon any verbal representations from the Owner, or the Owner's employees or agents including architects, engineers or consultants, in assembling the bid figure.

7. This proposal has been coordinated with & complies with all provisions of the contract documents (drawings, specifications, conditions, addenda) & includes all items of work required for complete & functional operation.

Respectfully submitted:

Signature _____

Name/Title _____

Company Name_____

Address (Seal if corporation)_____

ATTACHED IS A FULL DESCRIPTION OF ALL WORK INCLUDED IN THIS PROPOSAL.

00 43 43 - PREVAILING WAGE RATES

General Decision Number: TX190215 02/08/2019 TX215

Superseded General Decision Number: TX20180247

State: Texas

Construction Type: Building

Counties: Llano, Mason, McCulloch and Runnels Counties in Texas.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of $10.60 for calendar year 2019 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least $10.60 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2019. If this contract is covered by the EO and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must pay workers in that classification at least the wage rate determined through the conformance process set forth in 29 CFR 5.5(a)(1)(ii) (or the EO minimum wage rate,if it is higher than the conformed wage rate). The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/04/2019
1	02/08/2019

ASBE0066-006 03/01/2014

Runnels County

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR	$ 20.79	11.12

ASBE0087-011 01/01/2018

Llano, Mason and McCulloch Counties

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST		

INSULATOR	$ 22.72	10.02

BOIL0531-001 01/01/2017

	Rates	Fringes
Boilermaker	$ 28.00	22.35

IRON0066-009 09/01/2018

Mason County

	Rates	Fringes
IRONWORKER, REINFORCING AND STRUCTURAL	$ 22.05	6.73

IRON0263-022 06/01/2017

Runnels County

	Rates	Fringes
Ironworker, reinforcing and structural	$ 23.25	7.32

IRON0482-008 06/01/2017

Llano and McCulloch Counties

	Rates	Fringes
IRONWORKER, STRUCTURAL AND REINFORCING	$ 22.15	6.68

LABO0154-004 05/01/2008

Llano, Mason, and McCulloch Counties

	Rates	Fringes
Laborers: (Mason Tender - Cement/Concrete)	$ 12.98	3.49

LABO0154-024 05/01/2008

Runnels County

	Rates	Fringes
Laborers: (Mason Tender - Cement/Concrete)	$ 14.25	2.90

PLUM0286-005 06/04/2018

Llano and Mason Counties

	Rates	Fringes
PLUMBER, Excludes HVAC Pipe Installation	$ 29.50	12.82

* PLUM0404-001 09/01/2018

	Rates	Fringes
PLUMBER	$ 25.05	8.71

SUTX2009-102 04/20/2009

	Rates	Fringes
BRICKLAYER	$ 19.67	0.00
CARPENTER, Includes Acoustical Ceiling Installation, Drywall Hanging, and Metal Stud Installation	$ 13.13	0.00
CEMENT MASON/CONCRETE FINISHER	$ 13.27	0.00
ELECTRICIAN	$ 20.00	3.11
GLAZIER	$ 17.20	1.59
HVAC MECHANIC (HVAC Duct and Pipe Installation)	$ 14.21	0.77
INSTALLER - OVERHEAD DOOR	$ 11.63	6.26
LABORER: Common or General	$ 9.73	0.00
LABORER: Landscape & Irrigation	$ 8.50	0.22
LABORER: Mason Tender - Brick	$ 12.02	0.00
LABORER: Mortar Mixer	$ 12.00	0.00
LABORER: Plaster Tender	$ 9.00	0.00
OPERATOR: Backhoe/Excavator/Trackhoe	$ 13.75	0.00
OPERATOR: Bulldozer	$ 12.80	0.43
OPERATOR: Crane	$ 21.33	0.00
OPERATOR: Forklift	$ 14.58	0.00
OPERATOR: Loader (Front End)	$ 10.54	0.00
PAINTER: Brush, Roller and Spray	$ 12.26	0.00
PLASTERER	$ 15.50	0.00

ROOFER.....$ 13.64 1.80

SHEET METAL WORKER, Excludes
HVAC Duct Installation.....$ 17.00 0.00

TILE SETTER.....$ 15.00 0.00

TRUCK DRIVER.....$ 11.24 0.35

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where

applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

00 45 13 - BIDDER'S QUALIFICATIONS

PART 1 - GENERAL

1.1 GENERAL - It is the intention of these documents that only thoroughly qualified companies & individuals be employed on this project. The Owner may, at their option, reject the proposal of any proposer that does not meet the qualification criteria or submit required data as instructed. In considering a proposal for contract award, the Owner may also take into consideration the proposer's past history of successfully completing school projects, their financial solvency, history of timely payments to subcontractors, history of completing projects on time, safety record & history of cost control on projects.

1.2 SUBCONTRACTOR - Within 24 hours of proposal opening, the low proposer(s) & any other proposer notified by the Architect will deliver to the Architect's & Engineer's offices complete & notarized "Contractors Qualification Statement", AIA document A305 for proposed mechanical, plumbing, electrical, steel erection, & roofing subcontractors. As a minimum, all proposed subcontractors must meet, & show proof of, the following:

A. Three years in business under the current company name.

B. Experience of the proposed business entity on 3 public projects of equal or greater construction cost..

C. No involvement of proposed business entity or any of its principals in bankruptcy or bankruptcy reorganization for the past 5 years.

D. Full time employment of adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work.

E. Availability of all equipment required for proper performance of the work.

F. Financial reserves required for proper performance of the work.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION: NOT APPLICABLE

00 72 00 - GENERAL CONDITIONS

AIA® Document A232™ – 2009

General Conditions of the Contract for Construction, *Construction Manager as Adviser Edition*

for the following PROJECT:
(Name, and location or address)

Bond 2018 Projects and other construction later identified and specified by Owner
Brady, Texas

THE CONSTRUCTION MANAGER:
(Name, legal status and address)

DSA Construction Management
207 North Ridgeway
Cleburne, Texas 76033
(817) 465-8864

THE OWNER:
(Name, legal status and address)Brady Independent School District
1003 West 11th Street
Brady, Texas 76825
(325) 597-3301

THE ARCHITECT:
(Name, legal status and address)

Reliance Architecture, LLC1306 Barrington Drive
Austin, Texas 78753
(512) 758-7660

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Documents A132™–2009, Standard Form of Agreement Between Owner and Contractor, Construction Manager as Adviser Edition; B132™–2009, Standard Form of Agreement Between Owner and Architect, Construction Manager as Adviser Edition; and C132™–2009, Standard Form of Agreement Between Owner and Construction Manager as Adviser.

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TABLE OF ARTICLES

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(Topics and numbers in bold are section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents. The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement), and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of addenda relating to bidding requirements).

§ 1.1.2 The Contract. The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and the Construction Manager or the Construction Manager's consultants, (3) between the Owner and the Architect or the Architect's consultants, (4) between the Contractor and the Construction Manager or the Construction Manager's consultants, (5) between the Owner and a Subcontractor or Sub-subcontractor (6) between the Construction Manager and the Architect, or (7) between any persons or entities other than the Owner and Contractor. The Construction Manager and Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of their duties.

§ 1.1.3 The Work. The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project. The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by other Multiple Prime Contractors and by the Owner's own forces, including persons or entities under separate contracts not administered by the Construction Manager.

§ 1.1.5 The Drawings. The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

§ 1.1.6 The Specifications. The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service. Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker. The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect, or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 Transmission of Data in Digital Form

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Article 4, the Construction Manager and the Architect do not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Information and Services Required of the Owner

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the

portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities. Unless otherwise provided under the Contract Documents, the Owner, through the Construction Manager, shall secure and pay for the building permit.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.2.6 The Owner shall endeavor to forward all communications to the Contractor through the Construction Manager and shall contemporaneously provide the same communications to the Architect about matters arising out of or relating to the Contract Documents.

§ 2.3 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Construction Manager's and Architect's and their respective consultants' additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect, after consultation with the Construction Manager. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The plural term "Multiple Prime Contractors" refers to persons or entities who perform construction under contracts with the Owner that are administered by the Construction Manager. The term does not include the Owner's own forces, including persons or entities under separate contracts not administered by the Construction Manager.

§ 3.1.3 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.4 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Construction Manager or Architect in their administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Construction Manager and Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information submitted to the Construction Manager in such form as the Construction Manager and Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Construction Manager and Architect any nonconformity discovered by or made known to the Contractor as a request for information submitted to Construction Manager in such form as the Construction Manager and Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instruction concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner, the Construction Manager, and the Architect and shall not proceed with that portion of the Work without further written instructions from the Architect, through the Construction Manager. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of the Project already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect, in consultation with the Construction Manager, and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

The Contractor warrants to the Owner, Construction Manager, and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform with the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Construction Manager or Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work or portions thereof provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices, and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Owner, through the Construction Manager, shall secure and pay for the building permit. The Contractor shall secure and pay for other permits, fees, licenses and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner, Construction Manager, and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect and Construction

Manager will promptly investigate such conditions and, if the Architect, in consultation with the Construction Manager, determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect, in consultation with the Construction Manager, determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner, Construction Manager, and Contractor in writing, stating the reasons. If the Owner or Contractor disputes the Architect's determination or recommendation, either party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner, Construction Manager, and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents:

- **.1** Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner and Architect through the Construction Manager, the name and qualifications of a proposed superintendent. The Construction Manager may reply within 14 days to the Contractor in writing stating (1) whether the Owner, the Construction Manager, or the Architect has reasonable objection to the proposed superintendent or (2) that any of them require additional time to review. Failure of the Construction Manager to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner, Construction Manager or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information and the Construction Manager's approval a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project schedule to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

The Contractor shall cooperate with the Construction Manager in scheduling and performing the Contractor's Work to avoid conflict with, and as to cause no delay in, the work or activities of other Multiple Prime Contractors or the construction or operations of the Owner's own forces.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter update it as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Construction Manager's and Architect's approval. The Architect and Construction Manager's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Construction Manager and Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall participate with other Contractors, the Construction Manager and Owner in reviewing and coordinating all schedules for incorporation into the Project schedule that is prepared by the Construction Manager. The Contractor shall make revisions to the construction schedule and submittal schedule as deemed necessary by the Construction Manager to conform to the Project schedule.

§ 3.10.4 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner, Construction Manager and Architect and incorporated into the approved Project schedule.

§ 3.11 Documents and Samples at the Site

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These documents shall be available to the Architect and delivered to the Construction Manager for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect and Construction Manager is subject to the limitations of Sections 4.2.9 through 4.2.11. Informational submittals upon which the Construction Manager and Architect are not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Construction Manager or Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Construction Manager Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the Project submittal schedule approved by the Construction Manager and Architect, or in the absence of an approved Project submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of other Multiple Prime Contractors or the Owner's own forces. The Contractor shall cooperate with the Construction Manager in the coordination of the Contractor's Shop Drawings, Product Data, Samples and similar submittals with related documents submitted by other Multiple Prime Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner, Construction Manager, and Architect, that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked

and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been reviewed and approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Construction Manager and Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Construction Manager and Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.13 Use of Site

§ 3.13.1 The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.13.2 The Contractor shall coordinate the Contractor's operations with, and secure the approval of, the Construction Manager before using any portion of the site.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner's own forces or of other Multiple Prime Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner's own forces or by other Multiple Prime Contractors except with written consent of the Construction Manager,

Owner and such other Multiple Prime Contractors; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the other Multiple Prime Contractors or the Owner the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner, or Construction Manager with the Owner's approval, may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner, Construction Manager and Architect access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner, Construction Manager and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner, Architect, or Construction Manager. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect through the Construction Manager.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Construction Manager, Architect, Construction Manager's and Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 4 ARCHITECT AND CONSTRUCTION MANAGER

§ 4.1 General

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 The Owner shall retain a construction manager lawfully licensed to practice construction management or an entity lawfully practicing construction management in the jurisdiction where the Project is located. That person or entity is identified as the Construction Manager in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.3 Duties, responsibilities and limitations of authority of the Construction Manager and Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Construction Manager, Architect and Contractor. Consent shall not be unreasonably withheld.

§ 4.1.4 If the employment of the Construction Manager or Architect is terminated, the Owner shall employ a successor construction manager or architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Construction Manager or Architect, respectively.

§ 4.2 Administration of the Contract

§ 4.2.1 The Construction Manager and Architect will provide administration of the Contract as described in the Contract Documents and will be the Owner's representatives during construction until the date the Architect issues the final Certificate for Payment. The Construction Manager and Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner and Construction Manager (1) known deviations from the Contract Documents and from the most recent Project schedule prepared by the Construction Manager, and (2) defects and deficiencies observed in the Work.

§ 4.2.3 The Construction Manager shall provide a staffing plan to include one or more representatives who shall be in attendance at the Project site whenever the Work is being performed. The Construction Manager will determine in general if the Work observed is being performed in accordance with the Contract Documents, will keep the Owner reasonably informed of the progress of the Work, and will report to the Owner and Architect (1) known deviations from the Contract Documents and the most recent Project schedule, and (2) defects and deficiencies observed in the Work.

§ 4.2.4 The Construction Manager will schedule and coordinate the activities of the Contractor and other Multiple Prime Contractors in accordance with the latest approved Project schedule.

§ 4.2.5 The Construction Manager, except to the extent required by Section 4.2.4, and Architect will not have control over, or charge of, construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1, and neither will be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. Neither the Construction Manager nor the Architect will have control over or charge of or be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons or entities performing portions of the Work.

§ 4.2.6 Communications Facilitating Contract Administration. Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Construction Manager, and shall contemporaneously provide the same communications to the Architect about matters arising out of or relating to the Contract Documents. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with other Multiple Prime Contractors shall be through the Construction Manager and shall be contemporaneously provided to the Architect if those communications are about matters arising out of or related to the Contract Documents. Communications by and with the Owner's own forces shall be through the Owner.

§ 4.2.7 The Construction Manager and Architect will review and certify all Applications for Payment by the Contractor, in accordance with the provisions of Article 9.

§ 4.2.8 The Architect and Construction Manager have authority to reject Work that does not conform to the Contract Documents and will notify each other about the rejection. The Construction Manager shall determine in general

whether the Work of the Contractor is being performed in accordance with the requirements of the Contract Documents and notify the Owner, Contractor and Architect of defects and deficiencies in the Work. Whenever the Construction Manager considers it necessary or advisable, the Construction Manager will have authority to require additional inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, upon written authorization of the Owner, whether or not such Work is fabricated, installed or completed. The foregoing authority of the Construction Manager will be subject to the provisions of Sections 4.2.18 through 4.2.20 inclusive, with respect to interpretations and decisions of the Architect. However, neither the Architect's nor the Construction Manager's authority to act under this Section 4.2.8 nor a decision made by either of them in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons performing any of the Work.

§ 4.2.9 The Construction Manager will receive and promptly review for conformance with the submittal requirements of the Contract Documents, all submittals from the Contractor such as Shop Drawings, Product Data and Samples. Where there are Multiple Prime Contractors, the Construction Manager will also check and coordinate the information contained within each submittal received from Contractor and other Multiple Prime Contractors, and transmit to the Architect those recommended for approval. By submitting Shop Drawings, Product Data, Samples and similar submittals, the Construction Manager represents to the Owner and Architect that the Construction Manager has reviewed and recommended them for approval. The Construction Manager's actions will be taken in accordance with the Project submittal schedule approved by the Architect or, in the absence of an approved Project submittal schedule, with reasonable promptness while allowing sufficient time to permit adequate review by the Architect.

§ 4.2.10 The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Upon the Architect's completed review, the Architect shall transmit its submittal review to the Construction Manager.

§ 4.2.11 Review of the Contractor's submittals by the Construction Manager and Architect is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Construction Manager and Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Construction Manager and Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Construction Manager and Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.12 The Construction Manager will prepare Change Orders and Construction Change Directives.

§ 4.2.13 The Construction Manager and the Architect will take appropriate action on Change Orders or Construction Change Directives in accordance with Article 7. and the Architect will have authority to order minor changes in the Work as provided in Section 7.4. The Architect, in consultation with the Construction Manager, will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.14 Utilizing the documents provided by the Contractor, the Construction Manager will maintain at the site for the Owner one copy of all Contract Documents, approved Shop Drawings, Product Data, Samples and similar required submittals, in good order and marked currently to record all changes and selections made during construction. These will be available to the Architect and the Contractor, and will be delivered to the Owner upon completion of the Project.

§ 4.2.15 The Construction Manager will assist the Architect in conducting inspections to determine the dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion in conjunction with the Architect pursuant to Section 9.8; and receive and forward to the Owner written warranties and related

documents required by the Contract and assembled by the Contractor pursuant to Section 9.10. The Construction Manager will forward to the Architect a final Application and Certificate for Payment or final Project Application and Project Certificate for Payment upon the Contractor's compliance with the requirements of the Contract Documents.

§ 4.2.16 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.17 The Architect will interpret and decide matters concerning performance under, and requirements of the Contract Documents on written request of the Construction Manager, Owner or Contractor through the Construction Manager. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.18 Interpretations and decisions of the Architect will be consistent with the intent of and reasonably inferable from the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.

§ 4.2.19 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.20 The Construction Manager will receive and review requests for information from the Contractor, and forward each request for information to the Architect, with the Construction Manager's recommendation. The Architect will review and respond in writing to the Construction Manager to requests for information about the Contract Documents. The Construction Manager's recommendation and the Architect's response to each request will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include other Multiple Prime Contractors or subcontractors of other Multiple Prime Contractors.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Construction Manager for review by the Owner, Construction Manager and Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Construction Manager may reply within 14 days to the Contractor in writing stating (1) whether the Owner, the Construction Manager or the Architect has reasonable objection to any such proposed person or entity or, (2) that the Construction Manager, Architect or Owner requires additional time for review. Failure of the Construction Manager, Owner, or Architect to reply within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner, Construction Manager or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner, Construction Manager or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner, Construction Manager or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change,

and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner, Construction Manager or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner, Construction Manager and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner, Construction Manager and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor Contractor or other entity. If the Owner assigns the subcontract to a successor Contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor Contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY OTHER CONTRACTORS

§ 6.1 Owner's Right to Perform Construction with Own Forces and to Award Other Contracts

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, which include persons or entities under separate contracts not administered by the Construction Manager, and to award other contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 6.1.2 When the Owner performs construction or operations with the Owner's own forces including persons or entities under separate contracts not administered by the Construction Manager, the Owner shall provide for coordination of such forces with the Work of the Contractor, who shall cooperate with them.

§ 6.1.3 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11 and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner's own forces, Construction Manager and other Multiple Prime Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner's own forces or other Multiple Prime Contractors, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Construction Manager and Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's own forces or other Multiple Prime Contractors' completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs, including costs that are payable to a separate contractor or to other Multiple Prime Contractors because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of delays, improperly timed activities, damage to the Work or defective construction by the Owner's own forces or other Multiple Prime Contractors.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner, separate contractors, or other Multiple Prime Contractors as provided in Section 10.2.5.

§ 6.2.5 The Owner and other Multiple Prime Contractors shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, other Multiple Prime Contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Construction Manager, with notice to the Architect, will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Construction Manager, Architect and Contractor; a Construction Change Directive requires agreement by the Owner, Construction Manager and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 Change Orders

A Change Order is a written instrument prepared by the Construction Manager and signed by the Owner, Construction Manager, Architect and Contractor, stating their agreement upon all of the following:

.1 The change in the Work;

.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Construction Manager and signed by the Owner, Construction Manager and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Construction Manager and Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Construction Manager shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Construction Manager may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers compensation insurance;
.2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
.5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Construction Manager and Architect. When

both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Construction Manager and Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Construction Manager and Architect determine to be reasonably justified. The interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Construction Manager and Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Construction Manager shall prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order issued through the Construction Manager and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner, Owner's own forces, Construction Manager, Architect, any of the other Multiple Prime Contractors or an employee of any of them, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration, or by other causes that the Architect, based on the recommendation of the Construction Manager, determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 Schedule of Values

Where the Contract is based on a Stipulated Sum or Guaranteed Maximum Price, the Contractor shall submit to the Construction Manager, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Construction Manager and Architect may require. This schedule, unless objected to by the Construction Manager or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. In the event there is one Contractor, the Construction Manager shall forward to the Architect the Contractor's schedule of values. If there are Multiple Prime Contractors responsible for performing different portions of the Project, the Construction Manager shall forward the Multiple Prime Contractors' schedules of values only if requested by the Architect.

§ 9.3 Applications for Payment

§ 9.3.1 At least fifteen days before the date established for each progress payment, the Contractor shall submit to the Construction Manager an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner, Construction Manager or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Construction Manager and Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 Where there is only one Contractor, the Construction Manager will, within seven days after the Construction Manager's receipt of the Contractor's Application for Payment, review the Application, certify the amount the Construction Manager determines is due the Contractor, and forward the Contractor's Application and Certificate for Payment to the Architect. Within seven days after the Architect receives the Contractor's Application for Payment from the Construction Manager, the Architect will either issue to the Owner a Certificate for Payment, with a copy to the Construction Manager, for such amount as the Architect determines is properly due, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided

in Section 9.5.1. The Construction Manager will promptly forward to the Contractor the Architect's notice of withholding certification.

§ 9.4.2 Where there are Multiple Prime Contractors performing portions of the Project, the Construction Manager will, within seven days after the Construction Manager receives the Multiple Prime Contractors' Applications for Payment: (1) review the Applications and certify the amount the Construction Manager determines is due each of the Multiple Prime Contractors; (2) prepare a Summary of Contractors' Applications for Payment by combining information from each Multiple Prime Contractors' application with information from similar applications for progress payments from other Multiple Prime Contractors; (3) prepare a Project Application and Certificate for Payment; (4) certify the amount the Construction Manager determines is due all Multiple Prime Contractors; and (5) forward the Summary of Contractors' Applications for Payment and Project Application and Certificate for Payment to the Architect.

§ 9.4.3 Within seven days after the Architect receives the Project Application and Project Certificate for Payment and the Summary of Contractors' Applications for Payment from the Construction Manager, the Architect will either issue to the Owner a Project Certificate for Payment, with a copy to the Construction Manager, for such amount as the Architect determines is properly due, or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1. The Construction Manager will promptly forward the Architect's notice of withholding certification to the Contractors.

§ 9.4.4 The Construction Manager's certification of an Application for Payment or, in the case of Multiple Prime Contractors, a Project Application and Certificate for Payment shall be based upon the Construction Manager's evaluation of the Work and the information provided as part of the Application for Payment. The Construction Manager's certification will constitute a representation that, to the best of the Construction Manager's knowledge, information and belief, the Work has progressed to the point indicated and the quality of the Work is in accordance with the Contract Documents. The certification will also constitute a recommendation to the Architect and Owner that the Contractor be paid the amount certified.

§ 9.4.5 The Architect's issuance of a Certificate for Payment or in the case of Multiple Prime Contractors, Project Application and Certificate for Payment, shall be based upon the Architect's evaluation of the Work, the recommendation of the Construction Manager, and information provided as part of the Application for Payment or Project Application for Payment. The Architect's certification will constitute a representation that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated, that the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified.

§ 9.4.6 The representations made pursuant to Sections 9.4.4 and 9.4.5 are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Construction Manager or Architect.

§ 9.4.7 The issuance of a separate Certificate for Payment or a Project Certificate for Payment will not be a representation that the Construction Manager or Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed the Contractor's construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Construction Manager or Architect may withhold a Certificate for Payment or Project Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Construction Manager's or Architect's opinion the representations to the Owner required by Section 9.4.4 and 9.4.5 cannot be made. If the Construction Manager or Architect is unable to certify payment in the amount of the Application, the Construction Manager will notify the Contractor and Owner as provided in Section 9.4.1 and 9.4.3. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment or a Project Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Construction Manager or Architect may also withhold a Certificate for Payment or, because of

subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a Certificate for Payment or Project Certificate for Payment previously issued, to such extent as may be necessary in the Construction Manager's or Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from the acts and omissions described in Section 3.3.2 because of

.1 defective Work not remedied;
.2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
.3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a separate contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Architect or Construction Manager withholds certification for payment under Section 9.5.1, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Construction Manager and both will reflect such payment on the next Certificate for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment or Project Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Construction Manager and Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Construction Manager will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Owner, Construction Manager and Architect on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner, Construction Manager nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary

liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 Failure of Payment

If the Construction Manager and Architect do not issue a Certificate for Payment or a Project Certificate for Payment, through no fault of the Contractor, within fourteen days after the Construction Manager's receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Construction Manager and Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall notify the Construction Manager, and the Contractor and Construction Manager shall jointly prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the list, the Architect, assisted by the Construction Manager, will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the list, which is not sufficiently complete in accordance with the requirements of the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect, assisted by the Construction Manager, to determine Substantial Completion.

§ 9.8.4 When the Architect, assisted by the Construction Manager, determines that the Work or designated portion thereof is substantially complete, the Construction Manager will prepare, and the Construction Manager and Architect shall execute a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor and Construction Manager shall jointly prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall

be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect after consultation with the Construction Manager.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Construction Manager, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon completion of the Work, the Contractor shall forward to the Construction Manager a written notice that the Work is ready for final inspection and acceptance and shall also forward to the Construction Manager a final Contractor's Application for Payment. Upon receipt, the Construction Manager will evaluate the completion of Work of the Contractor and then forward the notice and Application, with the Construction Manager's recommendations, to the Architect who will promptly make such inspection. When the Architect, finds the Work acceptable under the Contract Documents and the Contract fully performed, the Construction Manager and Architect will promptly issue a final Certificate for Payment or Project Certificate for Payment stating that to the best of their knowledge, information and belief, and on the basis of their on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Construction Manager's and Architect's final Certificate for Payment or Project Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect through the Construction Manager (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Construction Manager and Architect so confirm, the Owner shall, upon application by the Contractor and certification by the Construction Manager and Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect through the Construction Manager prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents; or
- **.3** terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall submit the Contractor's safety program to the Construction Manager for review and coordination with the safety programs of other Contractors. The Construction Manager's responsibilities for review and coordination of safety programs shall not extend to direct control over or charge of the acts or omissions of the Contractors, Subcontractors, agents or employees of the Contractors or Subcontractors, or any other persons performing portions of the Work and not directly employed by the Construction Manager.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors;
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction; and
- **.4** construction or operations by the Owner or other Contractors.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2, 10.2.1.3 and 10.2.1.4, except damage or loss attributable to acts or omissions of the Owner, Construction Manager or Architect or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner, Construction Manager and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured,

shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to, asbestos or polychlorinated biphenyl (PCB),encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner, Construction Manager and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify a presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor, Construction Manager and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor, the Construction Manager and the Architect will promptly reply to the Owner in writing stating whether or not any of them has reasonable objection to the persons or entities proposed by the Owner. If the Contractor, Construction Manager or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor, the Construction Manager and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resumed upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Construction Manager, Architect, their consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Liability Insurance

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- **.1** Claims under workers' compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;
- **.2** Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- **.3** Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- **.4** Claims for damages insured by usual personal injury liability coverage;
- **.5** Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- **.6** Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle; and
- **.7** Claims for bodily injury or property damage arising out of completed operations; and
- **.8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be submitted to the Construction Manager for transmittal to the Owner with a copy to the Architect prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Construction Manager, the Construction Manager's consultants, the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.2 Owner's Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 Property Insurance

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or

entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for the Architect's, Contractor's, and Construction Manager's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 Boiler and Machinery Insurance. The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Construction Manager, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 Loss of Use Insurance. The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, adjoining or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that

the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 Waivers of Subrogation. The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees each of the other, and (2) the Construction Manager, Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as the Owner and Contractor may have to the proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Construction Manager, Construction Manager's consultants, Architect, Architect's consultants, Owner's separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or distribution of insurance proceeds in accordance with the direction of the arbitrators.

§ 11.4 Performance Bond and Payment Bond

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Construction Manager's or Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by either, be uncovered for their observation and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered which the Construction Manager or Architect has not specifically requested to observe prior to its being covered, the Construction Manager or Architect may request to see such Work

and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or one of the other Contractors in which event the Owner shall be responsible for payment of such costs.

§ 12.2 Correction of Work

§ 12.2.1 Before or After Substantial Completion

The Contractor shall promptly correct Work rejected by the Construction Manager or Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors or other Multiple Prime Contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 Written Notice

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity or to an officer of the corporation for which it was intended; or if delivered at or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 Rights and Remedies

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Construction Manager, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed in writing.

§ 13.5 Tests and Inspections

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Construction Manager and Architect timely notice of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Construction Manager, Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Construction Manager and Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Construction Manager and Architect of when and where tests and inspections are to be made so that the Construction Manager and Architect may be present for such procedures. Such costs except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Construction Manager's and Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Construction Manager for transmittal to the Architect.

§ 13.5.5 If the Construction Manager or Architect is to observe tests, inspections or approvals required by the Contract Documents, the Construction Manager or Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

§ 13.7 Time Limits on Claims

The Owner and the Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and the Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;

.3 Because the Construction Manager has not certified or the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner payment for Work executed including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner, Construction Manager and Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, after consultation with the Construction Manager, and upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Construction Manager's and Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall, upon application, be certified by the Initial Decision Maker after consultation with the Construction Manager, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and the Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent:

.1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of this Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition. A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 Notice of Claims. Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Construction Manager and Architect, if the Construction Manager and or Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 Continuing Contract Performance. Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Construction Manager will prepare Change Orders and the Architect will issue a Certificate for Payment or Project Certificate for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 Claims for Additional Cost. If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.3.

§ 15.1.5 Claims for Additional Time

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 15.1.6 Claims for Consequential Damages. The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- **.1** damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- **.2** damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5)

advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect and Construction Manager, if the Architect or Construction Manager is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.

Additions and Deletions Report for
AIA® Document A232™ – 2009

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

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PAGE 1

Bond 2018 Projects and other construction later identified and specified by Owner
Brady, Texas

...

DSA Construction Management
207 North Ridgeway
Cleburne, Texas 76033
(817) 465-8864

...

(Name, legal status and ~~address)~~address)Brady Independent School District
1003 West 11th Street
Brady, Texas 76825
(325) 597-3301

...

Reliance Architecture, LLC1306 Barrington Drive
Austin, Texas 78753
(512) 758-7660

Certification of Document's Authenticity

AIA® Document D401™ – 2003

I, , hereby certify, to the best of my knowledge, information and belief, that I created the attached final document simultaneously with its associated Additions and Deletions Report and this certification at 11:04:39 ET on 02/21/2019 under Order No. 7577949720 from AIA Contract Documents software and that in preparing the attached final document I made no changes to the original text of AIA® Document A232™ – 2009, General Conditions of the Contract for Construction, Construction Manager as Adviser Edition, as published by the AIA in its software, other than those additions and deletions shown in the associated Additions and Deletions Report.

_____

(Signed)

_____

(Title)

_____

(Dated)

00 73 17 - WORKERS COMPENSATION INSURANCE

A. Definitions:

(1) Certificate of coverage ("certificate"). A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project, for the duration of the project.

(2) Duration of the project. Includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the governmental entity.

(3) Persons providing services on the project ("subcontractor" in SS406.096.) Includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person contracted directly with the contractor and regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

B. The contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the contractor providing services on the project, for the duration of the project.

C. The Contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

D. If the coverage period shown on the contractor's current certificate of coverage ends during the duration of the project, the contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.

E. The contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

(1) a certificate of coverage, prior to that person beginning work on the project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project; and

(2) no later than seven days after receipt by the contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends daring the duration of the project.

F. The contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.

G. The contractor shall notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

H. The contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

I. The contractor shall contractually require each person with whom it contracts to provide services on a project, to:

(1) provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project;

(2) provide to the contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project;

(3) provide the contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;

(4) obtain from each other person with whom it contracts, and provide to the contractor.

- a certificate of coverage, prior to the other person beginning work on the project; and
- a new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;

(5) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;

(6) notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and

(7) contractually require each person with whom it contracts, to perform as required by paragraphs (1) - (7), with the certificates of coverage to be provided to the person for whom they are providing services.

J. By signing this contract or providing or causing to be provided a certificate of coverage, the contractor is representing to the governmental entity that all employees of the contractor who will provide services on the project will be covered by workers' compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

K. The contractor's failure to comply with any of these provisions is a breach of contract by the contractor which entitles the governmental entity to declare the contract void if the contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

DIVISION 01 – GENERAL REQUIREMENTS

01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY OF THE WORK: The general scope of this project includes, but is not limited to furnishing all materials, labor, fees, tools, accessories & equipment to completely perform all sitework, mechanical, electrical, plumbing, & general construction for this project.

1.2 GENERAL REQUIREMENTS: The Drawings represent the finished project & the definition of all project requirements will be provided by combining all of the Drawings. The General Conditions, Supplementary Conditions, & requirements of Division 1 & Division 0 apply to all sections of the specifications. The Contractor shall verify all field conditions which will affect the fabrication of components for new construction prior to the start of construction. Unless otherwise indicated, the drawings do not indicate the method of construction. All work will be provided complete, in the quickest time practical, & in a neat workmanlike manner. Provide any items of work not specifically indicated, but obviously or normally required to completely & properly execute the work. Use adequate numbers of skilled workmen who are thoroughly trained & experienced in the necessary crafts & who are completely familiar with the specified requirements & the methods needed for proper performance of the work.

1.3 GENERAL STRUCTURAL REQUIREMENTS: The Contractor shall take all measures necessary to protect the project during construction, including but not be limited to bracing and shoring of dead loads, construction loads and wind loads. The Contractor will be required to correct at his own expense any subsidence, structural damage or other objectionable conditions caused by his operations.

1.4 BUILDING SYSTEMS COORDINATION: Coordination is required by all trades with the work of all others to insure proper placement of each building system in relation to the others. The drawings & specifications are not intended to depict the exact location of each component. As the party in the field, the Contractor is in the best position to verify that the final placement all systems are coordinated. With the Architect's approval, make minor adjustments as may be required to accomplish a proper fit & coordination between building systems.

1.5 WATERTIGHTNESS: The drawings & specifications are not intended to depict each & every detail. As the party in the field, the Contractor is in the best position to verify that all conditions are completed to provide a watertight building envelope & the Contractor shall be responsible to do so.

1.6 DISCREPANCIES: Issuance of these construction documents (drawings and specifications) contemplates further cooperation among the Owner, the Contractor, and all parties involved in the design. Design and construction are complex, and although the design services have been performed with due care and diligence, perfection cannot be guaranteed. Communication is necessary and any discrepancy shall be reported immediately to the Architect whose interpretation shall be final and shall not be cause for claims for additional costs. Failure to provide written notice to the Architect, or changes made without consent, shall relieve the Owner, Architect & Engineers of responsibility for any consequences. Discrepancies not brought to the Architect's attention prior to acceptance of proposals will be deemed to have been proposed in the more costly manner.

1.7 REGULATORY REQUIREMENTS: All work will be performed in compliance with the latest edition of applicable regulatory requirements. Code requirement will establish the minimum requirements in the absence of direct instructions in the Construction Documents.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 11 16 - WORK BY OTHERS

PART 1 - GENERAL

1.1 ITEMS BY OWNER - Owner to provide material & labor for the following:

A. Meter deposits & tap fees

B. Building permit & inspection fees

C. Construction testing (except as noted otherwise, or retesting in the event of failure)

D. Furniture, fixtures & eqipment, including:

1. Cosmetology equipment and futniture

2. Cosmetology washer / dryer

3. Foodservice washer & dryer

E. Toilet Accessories, including:

1. Paper towel dispensers

2. Toilet paper dispensers

3. Soap dispensers

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 OWNER'S RESPONSIBILITIES: Negotiate selection, purchase, and delivery with Vendor. Transmit all pertinent information to Contractor via Architect. Pay for all costs, taxes, and delivery to the Work site. Coordinate delivery times with Contractor. Jointly inspect received products with Contractor. With Contractor's assistance, file shipping and damage claims. Obtain shop drawings. Obtain Special Warranties. Coordinate special training for operation and maintenance.

3.2 CONTRACTOR'S RESPONSIBILITIES: Coordinate delivery times with Owner. Show all Owner furnished products on Progress Schedule. Upon delivery to the Work site, inspect, handle, store, and protect in same manner as required for products purchased by Contractor. Assist Owner with filing shipping and damage claims. Repair or replace items damaged by construction activities.

01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED SECTIONS: 00700 General Conditions. See AIA A201 "General Conditions of the Contract for Construction", 1987 Edition. See AIA A201 "General Conditions of the Contract for Construction", 1987 Edition.

1.2 ALLOWANCE AMOUNTS: General Contractor/CMAR to include an allowance in the total contract amount for certain items of work not specified in other sections. These items include the following:

A. INTERACTIVE FLAT PANELS, MOUNTS, AND ACCESSORIES: $95,000

1.3 RENOVATION CONTINGENCY ALLOWANCE: Cost inclusions in Allowance will be directed by Owner, approved by Architect, and acknowledged by Contractor by means of a Change Order or Construction Change Directive for any costs associated with Concealed or Unknown Conditions. There will be no additional cost inclusions in Contract Sum for allowances otherwise.

1.4 ADMINISTRATION OF ALLOWANCES: Include all Allowances in Contract Sum. List each Allowance separately on Application and Certificate for Payment, the Progress Schedule, Schedule of Values, and any other applicable and appropriate listings. Subdivide each allowance as appropriate and as directed by Architect. Execute partial and final payments pursuant to same procedures as required for all other Subcontractors. At Contract Closeout, credit sums remaining in an allowance to Owner by Change Order.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDE - Designated Contractors: Provide unit prices on Bid Form for specified items.

1.2 DEFINITIONS: Unit Price means a fixed price, including all overhead, profit and all other costs of whatever nature and character, for a specified unit of work. Unit prices in the Bid Form, when accepted by Owner and incorporated into the Contract, shall be the same for additional, deducted or omitted units of work.

PART 2 - PRODUCTS

2.1 UNIT PRICE ITEM SCHEDULE

A. IP CAMERAS, RE: TECHNOLOGY ($/EA)

PART 3 - EXECUTION: NOT APPLICABLE

01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 DESCRIPTION: The Owner reserves the right to accept any or all Alternate Proposals. Base & related alternate items will not be awarded to separate contractors. Bidder may submit a price on any or all alternate items. Alternate bid items are to be stated as an addition or deduction from the base bid total.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 PROPOSAL ALTERNATES:

1. PROVIDE ADDITIONAL ACCESS CONTROLS AND CAMERAS, RE: TECHNOLOGY
2. PROVIDE STAINLESS STEEL COUNTERTOPS AND SPLASHES IN LIEU OF PLASTIC LAMINATE CLAD COUNTERTOPS AT CLASSROOM C113.
3. PROVIDE CHAIR RAIL & WAINSCOT AND PROVIDE LVT IN LIEU OF VCT AT CLASSROOM C113.
4. REMOVE EXISTING AND PROVIDE NEW PARTITIONS (06M) BETWEEN CLASSROOMS AT ELEMENTARY RENOVATIONS.
5. REMOVE EXISTING AND PROVIDE NEW WALL TILE AT ELEMENTARY CORRIDORS (AT ALL PARTITIONS EXCEPT INNER CORE).
6. REPLACE E201 FRAME AND DOORS, AND WINDOW ‘D’ AS SHOWN.

01 25 00 - SUBSTITUTIONS PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. Individual requirements for submittals are described in other pertinent Sections of the Specifications.

C. Architect provided Substitution Request Form.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract. Where a definite product is specified, it is not necessarily the intention to discriminate against other products, but rather to set a definite standard & indicate the quality & capacity of equipment within the class found satisfactory for the Owner's use. Alternate or substitute items shall not deviate in basic construction or function from the specified item. The acceptance of a manufacturer in no way allows the accepted manufacturer to substitute a product that does not conform to the originally specified item. It is incumbent upon the approved manufacturer to provide the item, quality & construction specified.

1.3 DEFINITIONS

A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

B. Substitutions: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:

1. Substitutions requested during the bidding period, and accepted by Addendum prior to award of the Contract, are included in the Contract Documents and are not subject to requirements specified in this Section for substitutions.

2. Revisions to the Contract Documents requested by the Owner or Architect.

3. Specified options of products and construction methods included in the Contract Documents.

4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

1.4 SUBMITTALS

A. Substitution Request Submittal: The Architect will consider requests for substitution if received within 30 days after date of Notice To Proceed. Requests received more than 30 days after date of Notice To Proceed may be considered or rejected without consideration at the discretion of the Architect.

1. Submit request for substation using CSI Form 1.5, edition June 2004, Substitutoin Request.

2. Submit request for substitution for consideration electronically. Failure to provide all requested information in the format requested will be grounds for rejection.

3. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.

4. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

   a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors, that will be necessary to accommodate the proposed substitution.

   b. A detailed side-by-side comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.

   c. Product Data, including Drawings and descriptions of products and fabrication and installation procedures.

   d. Samples, where applicable or requested.

   e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. The proposed substitution will not extend the Contract Time.

   f. Cost information, including a proposal of the net change, if any in the Contract Sum.

   g. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.

   h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.

1.5 CONSIDERATION

A. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. When the Architect approves a substitution, it is assumed that the manufacturer makes a product that is equal or that he will special build one that is equal. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.

   1. Extensive revisions to the Contract Documents are not required.

   2. Proposed changes are in keeping with the general intent of the Contract Documents.

   3. The request is timely, fully documented, and properly submitted.

   4. The specified product or method of construction cannot be provided within the Contract Time. The Architect will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.

   5. The request is directly related to an "or-equal" clause or similar language in the Contract Documents.

   6. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. The Owner's additional responsibilities may include compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner, and similar considerations.

   7. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

8. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.

9. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.

10. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

11. Where a proposed substitution involves more than one prime contractor, each contractor shall cooperate with the other contractors involved to coordinate the Work, provide uniformity and consistency, and assure compatibility of products.

B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

1.6 ARCHITECTS ACTION

A. Architect's Action: If necessary, the Architect will request additional information or documentation for evaluation within one week of receipt of a request for substitution. The Architect will notify the Contractor of acceptance or rejection of the substitution within 14 days of receipt of the request, or 7 days of receipt of additional information or documentation, whichever is later.

1. Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 26 00 - CONTRACT MODIFICATION

PART 1 - GENERAL

1.1 SUMMARY: This Section specifies administrative and procedural requirements for handling and processing contract modifications.

1.2 OWNER-INITIATED PROPOSAL REQUESTS: The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. Proposal requests issued by the Architect are for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.

1.3 CONTRACTOR-INITIATED PROPOSALS: When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect. Use AIA Document G709 for Change Order Proposal Requests.

1.4 MINOR CHANGES IN THE WORK: The Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on AIA Form G710, Architect's Supplemental Instructions.

1.5 CONSTRUCTION CHANGE DIRECTIVE: When the Owner and the Contractor disagree on the terms of a Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Maintain detailed records on a time and material basis of work required by the Construction Change Directive. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.6 CHANGE ORDER PROCEDURES Reimbursement for change orders will be limited to the actual cost of materials & labor, plus a 10% mark-up to the subcontractor & a 5% mark-up to the General Contractor. If no Subcontractor labor is involved, General Contractor may mark-up 10%. Equipment rental from the Contractor or subcontractor, office overhead & supervision will not be considered for reimbursement. Copies of all receipts for this work will be submitted with the relevant application for payment. A Change Order (AIA G701) or Architect's Field Order (AIA G708) must be issued prior to performing any such work. Work performed without proper authorization will, at the Architect's option, remain without reimbursement to the Contractor or be removed at the Contractor's expense. All Contractor initiated requests for change order will be submitted by Contractor on AIA G701. No extra time or resulting damages will be allowed as a result of time required to evaluate or process change orders.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 29 73 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 Arrange schedule of values on or consistent with format of AIA Document G703.

1.2 Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

1.3 Identification: Include the following Project identification on the schedule of values:

A. Project name and location.
B. Name of Architect.
C. Architect's project number.
D. Contractor's name and address.
E. Date of submittal.

1.4 Arrangement:

A. Utilize Table of Contents of this Project Manual. Identify each line item with number and title of major specification Section.

B. Identify site mobilization, bonds and insurance, and all cost for all other General conditions and Division 1 General Requirements.

C. Allowances: Provide separate line items in the Schedule of Values for each Allowance.

D. In case of projects with multiple sites or buildings included under one project, provide a breakdown per site and/or building.

1.5 Format: Format the schedule of values in tabular form with separate columns to indicate the following for each item listed:

A. Related Specification Section
B. Description of the Work
C. Change Orders (numbers) that affect value
D. Dollar value of the following
    1. Labor
    2. Materials

1.6 Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

1.7 Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

1.8 Revise schedule to list approved Change Orders, with each Application for Payment.

1.9 Revise schedule to show any costs againsts allowances charged, with each Application for Payment.

1.10 Submit an updated schedule with each Application for Payment.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies management and coordination activities including:

1. Coordination of construction and administrative activities.

2. Ceiling coordination drawings, which include responsibilities for the General Contractor and specific Subcontractors.

3. Bidder-design systems.

4. Meeting requirements.

B. Related Sections:

1. 01 25 00 - SUBSTITUTIONS PROCEDURES

2. 01 26 00 - CONTRACT MODIFICATION

3. 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION.

4. 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND OTHER SUBMITTALS

1.2 GENERAL COORDINATION PROVISIONS

A. Carefully study and compare Contract Documents before proceeding with fabrication and installation of Work. Promptly advise Architect of any error, inconsistency, omission, or apparent discrepancy discovered.

B. Allot time in construction scheduling for liaison with Architect; establish procedures for handling queries and clarifications. Use "Request for Interpretation" form for requesting information.

C. In addition to other specified meetings, hold coordination meetings and preconstruction conferences with personnel and subcontractors to ensure coordination of Work.

D. Coordinate scheduling, submittals, and Work of various Specification sections to avoid conflicts and ensure efficient and orderly sequence of installation of interdependent construction elements.

E. Coordinate Work of various Specification sections having interdependent responsibilities for installation, connection, and operation.

F. Where Bidder-Design systems and building elements are indicated, incorporate documentation of bidder's design into the submittal process and provide all substantiating documentation in a timely manner, including, but not limited to shop drawings, agency submittals and informational submittals as required by the individual technical sections.

G. Verify that characteristics of operating equipment are compatible with building utilities and services.

H. Except as otherwise indicated, conceal pipes, ducts, conduit and wiring in construction. Coordinate locations of fixtures and outlets with finish elements.

I. Make provision to accommodate items scheduled for later installation.

J. Coordinate and utilize Project Record Documents in Closeout Submittals.

K. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules.

2. Installation and removal of temporary facilities.

3. Delivery and processing of submittals.

4. Progress meetings and pre-installation conferences.

5. Project closeout activities.

1.3 REQUEST FOR INTERPRETATION (RFI)

A. When field conditions or Contract Document contents require clarification by the A/E or A/E's sub-consultants, after informal discussion with appropriate design team members determines that clarification is required or confirmation of understanding is needed, a written RFI is to be submitted.

B. Identify the nature and location of each clarification/verification using the RFI form; provide as a minimum the following information:
1. Project name and number;
2. Date;
3. Date response required by;
4. RFI number;
5. Subject;
6. Initiator of the question;
7. Indication of costs, if known or anticipated;
8. Indication of schedule impact;
9. Location on site;
10. Contract drawing reference;
11. Contract specification section and paragraph reference;
12. Descriptive text
13. Recommended solution(s); and
14. Space for reply on same page as questions.

C. Architect's response to RFIs will be made in writing within the time limits agreed upon with the Owner and Contractor or otherwise with reasonable promptness.

D. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished, then delay shall not be recognized on account of failure by the architect to furnish such interpretations until 15 days after written request is made for them.

E. If Architect is able to respond to a request for interpretation by making specific reference to Drawing sheet or Specification Section, Contractor shall reimburse Owner for charges of Architect and Architect's Consultants for performing review services for the Contractor.

F. The Contractor shall be responsible for development and weekly maintenance of an RFI log. The log will be transmitted to the Owner and Architect at each construction progress meeting.

1.4 MECHANICAL AND ELECTRICAL COORDINATION

A. Contractor shall:

1. Resolve all "tight", restricted, or inaccessible conditions involving Work of various Sections in advance of installation.

2. Before Work proceeds in these areas, prepare ceiling coordination drawings in accordance with paragraphs below.

3. Provide supplementary drawings and additional Work necessary to resolve problematic conditions.

1.5 CEILING COORDINATION DRAWINGS

A. General Requirements for Drawings:

1. Ceiling coordination drawings are not shop drawings and are not to be submitted to Owner or Architect for approval. Subcontractors shall be responsible to participate and prepare coordination drawings that illustrate their contract area of responsibility.

2. Ceiling coordination drawings shall show relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in space provided or to function as intended.

3. Prepare composite ceiling coordination drawings to scale of 1/4" = 1'-0" or larger; show ceilings, building structure above equipment, elevator shafts, duct shafts, mechanical systems, and electrical systems in relationship with each other. Include dimensions where critical.

4. Prepare ceiling coordination drawings utilizing different colors to illustrate work of separate trades.

5. Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to efficient flow of Work affecting one or more trades.

6. Locate drilled inserts and anchors to avoid structural reinforcements and maintain clearances as required by the Structural Drawings.

7. Mechanical Systems: Include, but do not necessarily limit to following:

a. Proposed locations of piping, ductwork, dampers, equipment, and terminations for HVAC, plumbing and fire sprinkler systems.

b. Proposed locations for access panels.

c. Clearances for installing and maintaining insulation.

d. Clearances for servicing and maintaining equipment.

8. Electrical Systems: Include, but do not necessarily limit to following:

a. Major raceway systems (i.e., cable tray, etc).

b. Panels.

c. Conduit and junction boxes for all electrical and fire alarm systems, including all low voltage systems.

d. Lighting fixtures.

e. Fire alarm devices.

f. Clearances for servicing equipment.

B. Documentation Process:

1. HVAC subcontractor shall initiate the coordination drawings and create the electronic drawing files with the appropriate background for the complete coordination process. Backgrounds shall include reflected ceiling plan, beam soffit elevations, ceiling heights, roof openings, and other items to be installed.

2. Each subcontractor shall incorporate their information via an added drawing layer on the background and transmit to the next trade. Drawings shall include accurate location, size, and elevation for each element to be installed by subcontractor. Each subcontractor shall be responsible to fully coordinate their work with the preceding trades (or "cloud" a possible conflict area for further review). The sequence of adding information and transmitting the drawings shall be as follows:

    a. HVAC Subcontractor

    b. Plumbing Subcontractor

    c. Fire Sprinkler Subcontractor

    d. Electrical Subcontractor.

3. Upon completion by all trades, drawings shall be transmitted back to the HVAC subcontractor for printing and issuance back to the Contractor. These final drawings will then be copied and used as a review tool and upon resolution of all conflicts, a construction aid. Final changes shall be made by the appropriate subcontractor and transmitted back to the HVAC subcontractor. HVAC subcontractor shall be responsible for issuing and transmitting back to the Contractor the final version of the coordination drawings.

4. Subcontractors shall coordinate with other affected trades to prevent conflicts and cooperate in making reasonable modifications in layouts as needed to coordinate systems in space available.

5. Subcontractors shall notify Contractor of remaining conflicts and other coordination issues requiring resolution prior to commencing construction in each affected area.

6. If necessary, Contractor will call meetings with subcontractors to resolve any remaining conflicts on the ceiling coordination drawings. Architect shall be invited to attend these meetings.

C. Contractor shall submit certification to Architect and Owner that coordination documents have been completed and coordination issues have been identified and resolve prior to commencing construction in each affected area. Certification shall be signed and dated by Contractor and each subcontractor indicating that:

1. All related conditions have been checked with all trades.

2. No apparent conflicts exist.

3. The requirements of the Contract Documents have been complied with.

4. All elements of a complete installation are included.

D. Contractor shall make coordination documents available in field office for review by Architect and Owner during entire period of construction.

E. BIM Option: At Contractor's option, Contractor and Subcontractors may utilize Building Information Management (BIM) software to accomplish the requirements of ceiling coordination drawings.

1.6 BIDDER-DESIGN SYSTEMS

A. Where indicated in the Contract Documents, provide design, engineering and fabrication for the complete installation of building system or assembly included in the Bidder's Cost of the Work. Include all accommodations for complete installation of system, including coordination with each trade forming a component part of the system or assembly as

required to meet the design and performance criteria, and as required to maintain the integrity of the building design aesthetic. Architect will be the judge for acceptance of Bidder-Design systems.

B. For systems identified in the Drawings as Deferred Submittals, submit documents per Sections on Submittal Procedures.

C. Coordinate in field with affected trades for proper relationship to Work based on Project conditions.

D. Notify Architect of conflicts and other coordination issues requiring resolution prior to commencing construction in each affected area.

1.7 COORDINATION OF SPACE

A. Coordinate use of Project space and sequence of installation of plumbing, fire protection, mechanical and electrical Work and as required by Ceiling Coordination Drawings, above. Follow routings shown for pipes, ducts, and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with building lines. Utilize space efficiency to maximize accessibility for other installations, for maintenance, and for repairs.

B. Layout of plumbing, fire protection, mechanical, and electrical systems, equipment, fixtures, piping, ductwork, conduit, specialty items, and accessories indicated on Drawings is diagrammatic. Variations in alignment, elevation, and details required to avoid interference and satisfy architectural and structural limitations are not necessarily shown.

C. Prior to installation of material and equipment, review and coordinate Work with Architectural and Structural Drawings to establish exact space conditions. Where available space is inadequate or where reasonable modifications are not possible, request information from Architect before proceeding.

D. Coordinate installation to prevent conflicts and cooperate in making, without extra charge, reasonable modifications in layout as needed.

E. Provide clear access to control points, valves, strainers, control devices, and specialty items of every nature related to such systems and equipment to obtain maximum head room. Provide adequate clearances as necessary for operation and maintenance.

1.8 COORDINATION OF CONTRACT CLOSEOUT

A. Coordinate completion and clean up of Work in preparation for Substantial Completion.

B. To minimize disruption of Owner's activities after occupancy of premises, coordinate access to site by various trades for correction of defective Work and for correction of Work not in accordance with Contract Documents.

1.9 GENERAL MEETING REQUIREMENTS

A. Schedule meetings and conferences throughout progress of Work; each session scheduled, administered, and presided by entity indicated. Requirements for meetings and conferences include:

1. Prepare agenda for each conference and meeting. Provide agenda to all attendees minimum 24 hours before meeting is scheduled to begin.

2. Distribute written notice to participants 7 days in advance of scheduled date.

3. Make physical arrangements.

4. Record minutes and attendees; include significant proceedings and decisions.

5. Distribute minutes electronically within 5 days after each meeting.

6. Distribute minutes to each participant and to entities affected by decisions made at meeting.

7. Distribute minutes to Architect and Owner.

8. Maintain in field office one copy of agenda and minutes for each conference and meeting.

B. Representatives attending meetings shall be qualified and authorized to act on behalf of entity each represents.

C. Architect and professional consultants may attend meetings to ascertain that Work is consistent with Contract Documents.

D. Owner may be present at meetings and may propose agenda items.

1.10 PRECONSTRUCTION CONFERENCE

A. Schedule preconstruction conferences no later than 7 days prior to commencement of Work. Convene at Project site.

B. Attendees:

1. Architect and professional consultants; Contractor presides over meeting and is responsible for minutes.

2. Owner.

3. Major subcontractors & trade foremen.

4. Others as appropriate.

C. Minimum Agenda:

1. Administrative and procedural issues:

2. Designation of key personnel.

3. Review and clarify responsibilities of parties to contract.

4. Communications procedures.

5. Review of proposed subcontractors, materials, equipment, and products.

6. Application for payment procedures; schedule of values, proposal requests, change orders.

7. Critical work sequencing; long lead time items and scheduling of full size mock-ups.

8. Submittal and construction progress schedules.

9. Submittal requirements; complete, correct, and timely submittals; scheduled dates.

10. Procedures for submitting product data, shop drawings, samples, and other submittals.

11. Product options and substitutions procedures to extent indicated in other Sections.

12. Procedures for requests for interpretations (RFI), minor changes, field decisions, construction change directives, proposal requests, change orders, and filing claims.

13. Procedures for testing and inspection, including timely notification, including review of preliminary testing at time of meeting.

14. Responsibilities and limitations of authority of testing laboratories; distribution of reports.

15. Procedures for maintaining Project Record Documents.

16. Schedule for progress meetings.

D. Site mobilization and utilization:

1. Use of premises; office and storage areas, including Owner's requirements.

2. Temporary utilities and services.

E. Interior Floor Slab Requirements

1. Effects of construction schedule, concrete work, timing of building enclosure, and temporary facilities such as construction drying; remediation options.

1.11 PROGRESS MEETINGS

A. Schedule weekly meetings as necessary by progress of Work; day, location, and time to be determined. Convene at Project site.

B. Attendees:

1. Contractor; presides over meeting and is responsible for minutes.

2. Subcontractors as appropriate.

3. Owner, Architect, and professional consultants may attend as appropriate.

4. Others as appropriate to agenda.

C. Minimum Agenda:

1. Approval of minutes of previous meeting.

2. Work progress since previous meeting:

a. Current activities.

b. Critical activities.

3. Deviations from schedule.

4. Field observations, problems, conflicts, and decisions.

5. Deficiencies:

a. Identification of items.

b. Status of correction.

6. Requests for Information (RFIs):

a. Review of RFI log.

b. Status of clarification and discipline responsible.

7. Status of change order proposals (COPs).

8. Changes and modifications:

    a. Status of change orders.

    b. Pending changes.

    c. Pending claims and disputes.

    d. Clarification decisions of Architect or Owner.

9. Problems and conflicts which impede planned progress.

10. Construction Progress and Submittal Schedules:

    a. Off-site fabrication and delivery schedules.

    b. Effect of proposed changes on construction progress schedule and coordination.

    c. Submittal schedules, status of submittals, and effect on construction progress schedule.

    d. Corrective measures to regain projected schedule.

11. Planned progress during succeeding Work period.

12. Adequacy of work forces.

13. Coordination between elements of Work.

14. Maintenance of Project Record Documents.

15. Other business relating to progress of Work.

D. Meeting Minutes:

1. Include column to indicate who is required to take action and date action is to be completed. Each of these items requiring action will be carried in subsequent minutes of meeting as "old business" until noted as "resolved."

2. As minimum, separate into following categories:

    a. Old business.

    b. New business.

    c. Work progress.

    d. Deficiencies.

    e. RFIs.

    f. Proposed changes.

    g. Schedules.

    h. Submittals.

    i. Other business, including events to be accomplished by next meeting.

1.12 PREINSTALLATION CONFERENCES

A. Schedule pre-installation conferences required in individual Specification sections. Convene at Project site prior to commencing Work of the section.

B. Attendees:

1. Project superintendent; presides over meeting and is responsible for minutes.

2. Subcontractor (installer, applicator, or erector).

3. Material or equipment supplier.

4. Manufacturers' representative.

5. Others directly affecting, or affected by the work.

6. Testing agency (if necessary).

7. Subcontractors as appropriate.

8. Owner, Architect, and professional consultants may attend as appropriate.

9. Others as appropriate to agenda.

C. Minimum Agenda:

1. Access to work and conditions of proper installation.

2. Conditions of installation, such as substrates, existing and surrounding conditions, and environmental conditions.

3. Conditions detrimental to installation.

4. Preparation procedures, including protection of adjacent work.

5. Verify installers' receipt and understanding of installation instructions.

6. Review submittals, installation procedures, and sequence.

7. Review coordination with other work.

8. Evaluate delivery schedule and Construction Progress Schedule.

9. Observe sample installation.

10. Required protection procedures.

11. Observe actual installation areas.

1.13 CLOSEOUT CONFERENCE

A. Schedule Project Closeout conference prior to requesting Substantial Completion.

B. Attendees:

1. Contractor; presides over meeting and is responsible for minutes.

2. Major subcontractors.

3. Owner, Architect, and professional consultants may attend as appropriate.

4. Others as appropriate to agenda.

C. Minimum Agenda:

1. Start-up of facilities and systems.

2. Testing, adjusting, and balancing.

3. System demonstration and observation.

4. Operation and maintenance instructions for the owner's personnel.

5. Contractor's inspection of work.

6. Contractor's preparation of an initial "punch list."

7. Procedure to request Architect inspection to determine date of substantial completion.

8. Completion time for correcting deficiencies.

9. Inspections by authorities having jurisdiction.

10. Certificate of occupancy and transfer of insurance responsibilities.

11. Partial release of retainage.

12. Preparation for final inspection.

13. Closeout submittals:

a. Project Record Documents.

b. Operating and maintenance documents.

c. Operating and maintenance materials.

d. Warranties and bonds.

e. Affidavits.

14. Final application for payment.

15. Final cleaning.

16. Contractor's demobilization of site.

17. Maintenance.

PART 2 PRODUCTS

2.1 NOT APPLICABLE

PART 3 EXECUTION

3.1 NOT APPLICABLE

01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 DESCRIPTION: The work progress schedule requirement is established to ensure adequate planning, scheduling, management, and execution of the work by the Contractor, and to enable the Owner to evaluate work progress and make contract time adjustments. The work specified in this section consists of submitting a contract schedule, monthly updates, four-week schedules for progress meetings, and a final as-built schedule. The planning, scheduling, management, and execution of the work in accordance with the contract is the responsibility of the Contractor.

1.2 SUBMITTALS: Except as modified in this section, the procedures required by Section 01 33 23, Submittal Procedures, shall be observed.

A. Submit a statement of CPM capability within 10 days following the Owner's delivery of the fully executed contract, stating that the Contractor has in-house capability, or if not, naming a scheduling subcontractor to be employed by the Contractor to prepare the schedules required. Include with this submittal scheduler's name and list of qualifications demonstrating that the scheduler has performed scheduling for projects of the same magnitude and complexity of this project. Failure to provide this information may result in disqualification of the proposed scheduler.

B. At the preconstruction meeting, submit for review by the Owner, a work progress schedule meeting the requirements below.

C. Within 5 days of receipt of review comments from the Owner, incorporate the Owner's comments, finalize, and resubmit the work progress schedule for Owner approval.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 CONTRACT SCHEDULE SUBMITTAL REQUIREMENTS

A. The contract schedule submittal shall be developed in Critical Path Method (CPM) format using Primavera Project Management (P6)□, Microsoft Project□, or pre-bid approved equal. It shall include:

1. A CPM Network Diagram:

a. Time-scaled (by week, starting Monday), grouped by work areas and sorted by early start dates.

b. The diagram shall be clear, neat, and legible. Each sheet shall contain a title block, a revision block, project name and contract number, Contractor, type of tabulation (initial, update, project status), project duration, scheduled substantial completion date, and a legend explaining the basic notation, terms, and codes used.

c. Identify critical path activities, including critical paths to contract milestone dates.

d. Activity durations shall not exceed 10 days. Should an activity require more than 10 days, it shall be subdivided to define appropriate activities. The Owner may approve using longer durations on such non-construction activities as the procurement and fabrication of materials and equipment.

e. All activity descriptions shall clearly define the location and type of work to be performed.

f. Show schedule critical deliverables (i.e., permits, submittals, etc).

g. Schedule fabrication and delivery of all materials and equipment.

h. Scheduled start or completion dates imposed on the schedule by the Contractor shall be consistent with contract milestone dates and other restrictions. Contract milestone dates are the work area starting and completion dates and shall be clearly identified and connected to the appropriate activities.

i. Schedule shall include contingencies for normal weather delays and seasonal periods of heavy traffic flow.

j. Schedule shall list resources required to perform work within durations shown. Indicate the estimated quantities of work anticipated where applicable.

k. Failure to include any element of work required for performance of this contract shall not excuse the Contractor from timely completion of work required to achieve the contract milestones, notwithstanding the acceptance of the contract schedule submittal.

l. The contract duration shall be the duration specified in the contract documents and awarded by the Owner.

m. Schedules extending beyond the contract completion date will not be accepted.

n. Schedules showing the work completed in less than the contract duration may be found by the Owner to be impractical, requiring resubmittal.

o. Schedules showing the work completed in less than the contract duration, if practical to the Owner, shall be considered to have Float. Float is the time between the scheduled duration of the work and the contract duration. Float is a resource available to both the Contractor and the Owner, and is non-compensable. Acceptance of a schedule showing the work completed in less than the contract duration shall not constitute a change to the contract completion date.

p. Schedule shall be coded by activity identifying shift work, restricted hours, electrical work, etc.

q. All Owner-required activities shall be shown as part of the critical path.

2. Narrative: The contract schedule submittal shall include a "stand-alone" document that conveys, in writing:

a. The Contractor's schedule assumptions; constraints; critical path/critical activities and why they are critical; permit requirements; coordination required with the Owner, other contractors, utilities or any other parties; and long lead delivery items.

b. Basis for resources. Include anticipated quantities of work for each activity and the production rates used in determining resource allocation for activities.

3. The contract schedule submittal shall include a compact disc containing a copy of the project files. All data shall be written to disk via the Primavera Project Management (P6)□, Microsoft Project□ Backup, or pre-bid approved equal utility.

4. The final, accepted work progress schedule shall be the baseline from which changes in duration and logic shall be determined and shall be the basis for planning, scheduling, managing and executing the work.

3.2 MONTHLY UPDATE REPORT

A. No later than 30 days after acceptance of the contract schedule and monthly thereafter, the Contractor shall submit a Monthly Update Report.

B. The Monthly Update Report shall consist of:

1. An updated CPM Network Diagram of the contract schedule, format as previously specified herein, and a compact disc containing an exact copy of the submittal. All data shall be written to disk via the Primavera Project Management (P6)□, Microsoft Project□ Backup, or pre-bid approved equal utility.

2. A narrative which identifies the work actually completed and reflects the progress along the critical path in terms of days ahead of or behind the contract milestone dates. Specific requirements of the narrative are as follows:

   a. If the Monthly Update Report indicates an actual or potential delay to the contract milestone dates, the narrative shall identify the problem, cause, and the activities affected.

   b. The narrative shall also address the following:

   c. A detailed change in duration of any activity and/or logic changes to activities which were performed in a sequence different from the accepted contract schedule.

   d. Activities proposed to be added to or deleted from the contract schedule.

   e. Identification of executed change orders.

3. Incorporation of all Owner-accepted schedule revisions.

4. The mutually agreed-to Monthly Update Report shall be the basis for evaluating the Contractor's progress. Documents in a single Monthly Update Report shall have the same data date irrespective of the dates of preparation of the individual documents.

5. If the latest completion time for any required contract milestone date as indicated by the current Monthly Update Report does not fall within the time allowed by the contract, the Contractor shall prepare and submit a plan to recover the lost time.

C. The Owner may call for more frequent status meetings (weekly, biweekly, etc.), at no additional cost to the Owner, at which the Contractor shall provide the required information.

D. Review of Monthly Update Report:

1. The Owner will review the monthly report and respond within 7 days after receipt.

2. If necessary, the Contractor shall resubmit within 7 days of receipt of review comments.

E. Applications for Payment: Submission of monthly schedule updates shall accompany applications for progress payments, and will be a condition of payment.

3.3 PROGRESS MEETING SCHEDULES: During on-site construction, at each progress meeting, the Contractor shall provide a one week back and three week forward activity schedule. This schedule shall be in Gantt bar chart form and include, but not be limited to, reporting of the following:

A. Detailed listing of specific work items, duration of work items, actual work hours, resources to be used in accomplishing work items, work area closing and opening dates and times, operational impacts, and other pertinent items.

B. The weekly progress meeting schedules shall be submitted not less than 24 hours in advance of the scheduled progress meeting.

3.4 SCHEDULE MONITORING: If the progress of critical path activities falls behind the time lines shown on the latest, accepted version of the CPM schedule by 7 days, the Contractor shall document the means he will employ to bring work back on schedule.

3.5 CONTRACT SCHEDULE REVISIONS: Proposed revisions to the accepted contract schedule shall be submitted to the Owner on a separate fragnet for review and acceptance prior to incorporation into the current contract schedule. This fragnet must clearly

outline the impact of the revision within the context of the contract schedule. Each proposed revision shall be submitted with the following minimum components:

A. A CPM Network Diagram showing revised and affected activities.

B. An Activity Report and Predecessor/Successor Report for all revised and affected activities.

3.6 CONTRACT TIME ADJUSTMENTS: Float is not for the exclusive use or benefit of either the Owner or the Contractor. Extensions of time for contract performance as specified in the contract will be granted only to the extent that time adjustments to the affected work items exceed the total float time along the affected path(s) of the contract schedule current at the time of the delay.

3.7 AS-BUILT SCHEDULE AND DOCUMENTATION: Within 15 days after substantial completion, the Contractor shall submit for the Owner's acceptance a final, as-built CPM Network Diagram.

3.8 SUSPENSION OF PAYMENTS: If the Contractor fails at any time to submit a schedule or update as noted above, the Owner reserves the right to suspend progress payments wholly or in part until the Contractor submits a schedule which is accepted by the Owner.

01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND OTHER SUBMITTALS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The purpose of Contractor submittals is to demonstrate for those portions of the Work for which submittals are required, the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents.

B. By approving and submitting submittals, the Contractor/CM represents that the Contractor/CM has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information within such submittals with the requirements of the Work and of the Contract Documents.

C. The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals. The Architect's review is only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

1.2 GENERAL REQUIREMENTS

A. All submittals to be made by Electronic Submission in PDF format.

B. Submittals shall be initiated by the trade contractor, submitted to the Contractor/CM for review & approval, & then submitted to the Architect for action.

C. Submit submittal register & receive architects concurrence prior to any other submissions.

D. Schedule submittals to allow adequate time for review and resubmission, if necessary.

E. Submittals may be returned without action if made out of sequence or schedule, or are missing required information.

F. All food service submittals must be submitted at once with extra time for review.

G. All Doors, Frames & Storefront must be submitted at one time.

H. Please allow extra review time for the following submittals, as they will likely take longer than two weeks:
1. Structural Steel
2. Metal Building
3. Hollow Core Planks
4. Rebar
5. MEP
6. Food Service
7. Doors & Storefront
8. Casework

1.3 PROJECT INITIATION SUBMITTALS - Prior to the submission of any application for payment, submit the following:
A. Executed Agreement & any amendments
B. Project Construction schedule
C. Schedule of values
D. Insurance certificates
E. Performance & payment bonds
F. Project Submittal Schedule
G. Final list of all trade contractors/ subcontractors
H. Sub-contractor & superintendent qualifications
I. Pre-construction conference agenda & schedule
J. Schedule of projected rain days per month

1.4 SCHEDULING

A. Prepare & submit to Architect for approval a submittal register showing all required Shop Drawings, Product Data, Samples. Schedule item submission date and projected approval date as required to not cause delay to construction schedule.

B. Schedule and submit concurrently submittals covering component items forming a system or items that are interrelated. Include certifications to be submitted with the pertinent drawings at the same time. No delay damages or time extensions will be allowed for time lost in late submittals. An additional 10 calendar days will be allowed and shown on the register for review and approval of submittals for food service equipment, structural steel & HVAC control systems.

C. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential resubmittal of requirements.

D. Submittals called for by the contract documents will be listed on the register. If a submittal is called for but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Architect does not relieve the Contractor of supplying submittals required by the contract documents but which have been omitted from the register or marked "N/A."

E. Re-submit register and annotate monthly by the Contractor with actual submission and approval dates. When all items on the register have been fully approved, no further re-submittal is required.

F. Carefully control procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

1.5 SHOP DRAWINGS: Present in a clear and thorough manner. Title each drawing with Project name and number; identify each element of shop drawings by reference to sheet number and detail, schedule, or other appropriate identification of Contract Documents. Identify field dimensions; show relation to adjacent products or elements of the Work; show critical features.

1.6 PRODUCT DATA: Submit only pages which are pertinent; mark product data to specifically identify only pertinent products; reference each to Specification Section and Article number. Show standards, performance characteristics, and capacities; wiring and piping diagrams; controls; component parts; finishes; dimensions; and required clearances. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information not applicable.

1.7 COLOR SELECTION SAMPLES: Color selection samples for all exterior items and all interior items requiring such will be submitted together at one time, no longer than 45 days after notice to proceed.

1.8 SAMPLES: Submit full range of manufacturer's standard finishes of the actual product, except when more restrictive requirements are specified, indicate colors, textures, and patterns for Architect selection. Submit samples to illustrate functional characteristics of products, including parts and attachments.

1.9 MANUFACTURER'S PUBLISHED INSTRUCTIONS: Furnish manufacturer's published instructions for storage, preparation, assembly, installation, start-up, adjusting, balancing, and finishing.

1.10 SUBMITTAL REQUIREMENTS: Apply Contractor/CM's approval certification, certifying to review, verification of products, field dimensions, quantities, field construction criteria, and coordination of information with requirements of Work and Contract Documents. Coordinate submittals into logical groupings to facilitate interrelation of the several items: 1. Finishes which involve Architect selection of colors, textures, or patterns. 2. Associated items which require correlation for efficient function or for installation.

1.11 HARDCOPY SUBMITTAL: As requested by Architect, submit opaque reproductions of shop drawings, product data and manufacturer's published instructions. Submit number of samples specified in individual Specifications Sections. Identify Project by title and number. Identify Work and product by Specifications section and Article number.

1.12 RESUBMITTALS: Make re-submittals under procedures specified for initial submittals; identify changes since previous submittal.

1.13 CONTRACTOR'S EXAMINATION: Review submittals prior to delivery to Architect; verify quantities, field measurements, field construction criteria, assembly and installation requirements, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents. Sign or initial each sheet of shop drawings and product data, and each sample label to certify coordination and compliance with requirements of Contract Documents. Notify Architect in writing at time of submittal of any deviations from requirements of Contract Documents. Do not fabricate products or begin work which requires submittals until return of submittal with Architect acceptance. Contractor will receive, review, approve & forward multiple copies of product submittals & shop drawings to the Architect in a timely manner. Do not proceed with manufacture prior to review of shop drawing. Architect's review is only for general conformance with design concept & Contract Documents' requirements. Contractor is responsible for confirming & correlating dimensions, & construction techniques. Architect's review & action does not allow deviation from the requirements of the Contract Documents, does not relieve Contractor, Subcontractor or supplier from complying with every aspect of the Contract Documents, nor from responsibility for errors & omissions in submittals.

1.14 ARCHITECT'S REVIEW: Allow 14 days for Architect's review of each submittal. Daily allowance is time in possession of Architect and exclusive of delivery from and to Contractor and exclusive of resubmissions. Architect's review is limited to aesthetics, architectural design, and information contained in Contract Documents. Similarly, Consultant's review is limited to design relating to its specific field of expertise and its information contained in Contract Documents. Architect's or Consultant's review is neither a verification of Contractor's examination nor a substitution of Contractor's responsibilities. Architect or Consultant may inform Contractor of any conspicuous errors on a submittal without prejudice to being held harmless to Contractor's examinations and responsibilities.

1.15 DISTRIBUTION: Duplicate as necessary and distribute reproductions of shop drawings, products data, manufacturer's instructions, and samples, which bear Architect stamp of approval, to Project site, Subcontractors, suppliers, and other entities requiring information.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 35 00 - SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings Specifications or other conditions of the contract, apply to this section

1.2 PUBLISHED REGULATIONS: The Contractor shall at all times abide by the published City ordinance, regulations, laws, etc. of the Owner and all amendments, including those that may be issued during the duration of the Contract. Particular attention is called to those regulations pertaining to circulation, noise, sanitation, safety and behavior.

1.3 OUTAGES: When required during any occupancy of the buildings by the Owner, utility and service outages shall be kept to a minimum and will be permitted only with written advance approval of the Owner. Outages that will, in the opinion of the Owner, severely affect building occupants must be completed during off-hours or on weekends or holidays at no additional cost to the Owner. Work on off-hours, weekends and/or holidays shall comply with the Owner's policies and the City ordinances and comply with any special permits as issued by the City. Contractor shall give sufficient advance notice to the Owner of a requirement for utility outages to permit Owner to make necessary arrangements with those affected. All requests for outages shall be made in writing to the Owner a minimum of seven (7) calendar days in advance of the interruption in service. Service outages (electrical, water, sewerage, telephone, TV cable, gas, or any other public or private utility serving the Owner's property) shall not be interrupted during normal business hours. In the event the Work requires disruption of service(s), the Contractor shall schedule this work for non-business hours at no additional cost to the Owner. Necessary utility and service outages affecting off-site properties and persons shall be arranged with the related utilities and public authorities at the sole expense of the Contractor. Requests for outages will not be considered unless they include an identification of all areas which will be affected by the proposed outage. Contractor shall be responsible for all costs of the Owner arising from outages occurring without approval of the Owner, including accidental outages.

1.4 MAINTENANCE OF BUILDING SECURITY: The Contractor shall make every effort to maintain the security of the construction site. The Contractor shall cooperate with the Owner in particularly sensitive areas where security and special safeguards are required.

1.5 PROTECTIVE NIGHT LIGHTING: The Contractor shall provide adequate outdoor lighting to illuminate security zones, staging, stockpiles, trenches, projections, and the like, with the intent of protecting the materials and construction from vandalism, theft, and to protect the public from injury and property damage. Such lighting shall be in addition to temporary power and lighting required under the Temporary Facilities Section. Cost for installing protective night lighting shall be included in the Contractor's contract price for the work.

1.6 PUMPING AND DRAINING: The Contractor shall take over the responsibility for site drainage in areas under his control upon entering the premises and shall maintain such drainage during the life of this Contract as approved by the Owner, and/or Architect, and so as not to adversely affect the adjacent areas. Legally remove by pumping, draining or bailing any water which may accumulate or be found on the site within the contract limits where excavating and grading are to be done, whether from snow, rain, surface flow, springs, ground water, backing up of drains or sewers, or from any other cause, always, and under any circumstances and contingencies that may arise. Form all pump wells, sumps, dams, flumes or other necessary works to keep trenches and excavations entirely clear of water. The Contractor shall have at all times upon the site, sufficient and satisfactory pumping machinery. Pump wells or well points and underdrains as may be required, shall be provided where needed to properly handle the water. The final trimming excavation shall not be done until dewatering means are in place and in operation. Water from trenches and excavations shall be disposed of in accordance with applicable law so as to not cause injury to public health nor to public or private property, nor to the existing work or to the work completed or in progress, nor to the surfaces of roads, walks, and streets, nor cause any interference with the use of the same by the public. Newly made and existing concrete and masonry shall be protected from injury resulting from dewatering work by protective coverings.

1.7 BROKEN GLASS: The Contractor shall be responsible for all broken, cracked, and/or scratched glass (new and existing) damaged during the construction period and shall replace all such defective glass before final acceptance.

1.8 HOURS OF WORK: The contractor, in preparing all schedules and in undertaking all work, shall respect the following time restrictions: Monday to Saturday-7:00AM to 7:00PM-Holidays excluded. All work schedules are subject to City ordinances. Other time may apply as requested and approved by the Owner.

1.9 EMERGENCY PHONE CONTACT LIST: Each contractor shall provide an emergency phone number contact list for their firm and all subcontractors. List to be kept current during the entire construction period.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 41 00 - REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 All work will be performed in compliance with the latest edition of applicable regulatory requirements. Code requirement will establish the minimum requirements in the absence of direct instructions in the Construction Documents. Applicable regulatory requirements include the following:

A. International Building Codes.

B. National Electric Code.

C. NFPA 101 - Life Safety Code.

D. Texas Accessibility Standards.

E. Americans with Disabilities Act.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 41 33 - ACCESSIBILITY REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL: Comply with facility requirements of the Americans with Disabilities Act Accessibility Guidelines (ADAAG) & the Texas Accessibility Standards (TAS). In addition to any attributes of new construction or alterations indicated in other sections or in the drawings, comply with the requirements of this section.

1.2 WALKWAY REQUIREMENTS: Minimum clear width - 42". Running slope - 1:20 maximum. Cross slope - 1:50 maximum. Change in level from 0.25" to 0.50" requires 1:2 beveled edge. Change in level greater than 0.50" requires ramp. Surface to be firm, stable & non-slip. Walkway grates to have no gap greater than 1/2" in the direction of travel.

1.3 ACCESSIBLE PARKING: Locate as shown, as close as practical to accessible entry. Standard space is 96" wide with 60" side aisle. Van space is 96" wide with 96" side aisle. Two spaces may share an aisle. Maximum slope 1:50. Provide designating signage.

1.4 CURB RAMPS: Provide curb ramp wherever an accessible route crosses a curb. Maximum slope 1:12 & a minimum of 36" wide. Do not project into traffic lanes. Surface to be either truncated dome per 4.29.2 of TAS, or grooves 1/8" deep, 1/4" to 3/4" wide, & 3/4" to 2" apart.

1.5 RAMPS: Provide ramps wherever slope of accessible route exceeds 1:20, as shown. Maximum slope 1:12 if rise greater than 6", with transitions flush. Minimum width 36". Provide 1.25"-1.50" handrail both sides, 34"-38" above ramp surface. Surface firm, stable & slip-resistant. Provide edge protection at drop-offs.

1.6 ENTRIES: At all entries, 5' approach on either side of entry to have a slope no greater than 2%.

1.7 DOORS: Provide accessible doors at accessible entrances & into accessible space, as shown. Provide clear opening of 32" minimum, with the door 90 deg open (face of door to stop). Maximum threshold height - 1/4". Provide lever operated, push-type, or U-shaped handles. Adjust new & existing interior doors with closers to open with less than 5 lbf force. Adjust interior & exterior doors to close from 70 degrees open to 3" from latch in no less than 3 seconds.

1.8 DRINKING FOUNTAINS: Accessible drinking facilities shall be provided, as shown. Spout heights at 36" and 40”. Spout height, location, controls, operation & clearances meet Americans with Disabilities Act Accessibility Guidelines (ADAAG).

1.9 WATER CLOSETS: Provide at least 1 accessible WC for both men & women, as shown. Seat height to be from 17" to 19". Provide grab bars. Flush controls & dispenser mounting location to meet ADAAG.

1.10 TOILET STALL: Provide at least 1 accessible toilet stall for both men & women, as shown. Minimum dimensions - 36" wide x 69" deep, with 32" outward swinging door. Provide a 42" grab bar at each side.

1.11 URINALS: Provide accessible urinal(s) with elongated rim at 17" above floor. Provide required clear floor space & flush controls to meet ADAAG.

1.12 LAVATORIES & MIRRORS: Provide accessible lavatory & mirror for both men & women toilet rooms, as shown. Lavatory to be less than 34" high & extend at least 17" from wall, with knee clearance below; provide insulation on drain & hot water pipes. Controls must be operable by the handicapped. Mirrors must be mounted with bottom 40" high maximum.

1.13 GRAB BARS: Provide 42" minimum length grab bars as shown. Bar diameter 1.5"; space from bar to wall 1.5". Mounting to support 250 lb.

1.14 SIGNAGE: Provide signs which designate permanent rooms that may be used by the public, complying with ADAAG requirements for braille, character, height, finish & contrast. Directional signs to functional spaces shall comply with requirements for character, height, finish & contrast (directories are exempt). Designate accessible parking, loading, entrances, & toilet facilities with the international symbol of accessibility. Provide sign at non-accessible entries directing to accessible entries. Room signs shall be on the wall at the latch side of the door, 60" AFF to centerline.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 42 13 - ABBREVIATIONS AND ACRONYMS

PART 1 - GENERAL

1.1 Abbreviations used generally follow the Construction Specifications Institute publication TD 2-4, November 1986. In the case of any discrepancy or question on the part of the Contractor, written request for clarification should be submitted immediately to the Architect. The Architect's resulting interpretation of abbreviations is final & binding on all parties involved in the work.

PART 2 - PRODUCTS: NOT APPLICABLE

PART 3 - EXECUTION: NOT APPLICABLE

01 45 23 - TESTING AND INSPECTING SERVICES

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED: The Owner shall provide or contract for, independently of the contractor, the inspection services, the testing of construction materials, and the verification testing services necessary for acceptance of the facility by the district.

1.2 DUTIES OF THE GEOTECHNICAL ENGINEER: Attend preconstruction meeting. Review available soils information performed for the project. Monitor the subgrade and fill pad preparation below the building area and the method of construction of this pad. Perform specified testing and sampling of earthwork materials. Ascertain compliance of materials and pad preparation with the requirements of the Contract Documents. Perform additional tests or monitoring of the work as deemed necessary by the Geotechnical Engineer, the Architect, Engineer, the Contractor or the Owner. Submit written report of each test and inspection performed with a copy directly to the Structural Engineer in accordance with Section 01 31 00. Submit a statement with a copy directly to the Structural Engineer at the completion of the related part of the project summarizing the services performed and the compliance/noncompliance of the test results or items monitored with regard to the specified requirements. Statement shall be signed and sealed by the Geotechnical Engineer.

1.3 ADDITIONAL RESPONSIBILITIES OF THE CONTRACTOR: Cooperate with geotechnical engineer's representatives, provide access to Work and to manufacturer's operations and provide adequate facilities as required for storage and curing of test samples. Secure and/or deliver to the geotechnical engineer adequate quantities of representational samples of materials proposed to be used and which require testing. Provide copies of product's test reports as required. Furnish one complete set of project plans and specifications to the Geotechnical Engineer to facilitate inspections and testing and to provide direction on the storage and curing of test samples. Assist geotechnical engineer in obtaining and handling samples at the Project site or at the source of the product to be tested. Notify geotechnical engineer sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests. Submit a written statement with a copy directly to the Structural Engineer at the completion of the Project stating that to the best of his knowledge, the Structural Portion of the Project has been built in accordance with these plans and specifications. Employ and pay for the services of the geotechnical engineer to perform additional inspections, sampling and testing required:

A. For the Contractor's convenience.

B. When initial tests indicate Work does not comply with Contract Documents.

1.4 SPECIFIC TESTS, INSPECTIONS AND METHODS REQUIRED: Geotechnical engineer shall provide the following soil testing/monitoring of the subgrade and fill pad:

A. A minimum of at least one laboratory test for moisture-density relationship of the subgrade material. Test in accordance with Texas Highway Department Test Procedure TEX 113E.

B. A minimum of at least one laboratory test for moisture-density relationship of the select fill. Test in accordance with Texas Highway Department Test Procedure TEX 113-E.

C. One field density test each 2,000 SF for subgrade below building for "Density Control of Compaction" in accordance with latest ASTM D-2922 and ASTM D-3017.

D. One field density test per lift each 2,000 SF for select fill below building for "Density Control of Compaction in accordance with latest ASTM D-2922 and ASTM D-3017.

E. Pier inspection & monitoring.

F. At least one field density test per lift for each 200 linear feet of select fill within plumbing trenches for "Density Control of Compaction" in accordance with latest ASTM D-2922 and ASTM D-3017. Fill material below the pipe and up to 12" above the pipe need not be tested for compaction.

G. Any other tests specifically required by other sections of the specifications.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 50 00 - TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 CONSTRUCTION UTILITIES: Construction utilities are to be provided by the Contractor.

1.2 TEMPORARY JOB SIGN: Provide a 4'x 8'x 5/8" plywood job sign with professionally printed and attached full color vinyl graphics, securely mounted on 4x4 posts, the design & location of which will be provided by the Architect. This sign will be erected within 2 weeks after the contract date & prior to any request for payment. No other construction signage will be allowed.

1.3 FIELD OFFICE: Provide & maintain a clean, secure, weathertight, temporary field office with electrical & phone service during the course of the project; cell phone use is acceptable. A complete set of Construction Documents & daily project log will be kept there at all times.

1.4 TRASH RECEPTACLES: Provide trash receptacles on the job site. Each trade is responsible for their own clean-up, to be performed daily. If not performed in a timely manner the Owner may have this work done separately & charged against the contract amount.

1.5 PORTABLE TOILET: Provide & properly maintain a portable toilet on site for the use of the workers. Workers shall use portable toilet facilities provided by the General Contractor / CM and shall not use other onsite restroom facilities or those of the project under construction.

1.6 PERIMETER SECURITY: Provide perimeter security to control access to the site by means of appropriate fencing, gates & barricades.

1.7 CONSTRUCTION ENTRY: Provide rock entry as required by governing jurisdiction & to limit mud from adjacent roadways.

1.8 SURVEYING & LAYOUT MEASUREMENT: Contractor is responsible for setting any and all other elements necessary to the Work. Means and methods for those settings are at selection of Contractor. Set appropriate and accurate locating devices as required for the Work.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 Description: This item shall govern the proper care and treatment of all trees and other vegetation in the vicinity of any development activity.

1.2 Submittals: The submittal requirements for this specification item shall include:

A. Identification of the location, type of protective fencing (i.e. A, B or C), materials of construction and installation details;
B. Proposed tree dressing;
C. Type, location and construction details for proposed tree wells;
D. Location, type, materials of construction and installation details for permeable paving;
E. Type and rate of application of fertilizer.

1.3 Quality Assurance:

A. Tie back branches to provide temporary clearance.
B. Do not prune if boring insects are flying (they are attracted to fresh wounds).
C. All pruning shall be performed by qualified arborist (ISA Certified Arborist or Tree Worker).
D. All pruning shall follow ISA's Tree Pruning Guidelines or most recent ANSI A300 Pruning Standards, and ANSI Z133.1 Safety Standards.

PART 2 - PRODUCTS

2.1 Protective Fencing: Protective fencing is designated as the materials used to protect the root zones of trees as illustrated in City of Austin Standard Detail 610S-1. Three basic types of protective fencing materials are allowed. Type A and Type B are typical applications and shall be installed where damage potential to a tree root system is high, while Type C shall be installed where damage potential is minimal. The specific type of protective fencing for the work shall be as indicated on the Drawings. Type C fence materials shall be subject to approval by the Architect. Type C fencing shall be replaced by Type A or Type B fencing as directed by the Engineer or designated representative if it fails to perform the necessary function.

A. Type A Chain Link fence (Typical Application-high potential damage): Type A protective fencing shall be installed in accordance with City of Austin Standard Details 610S-2 and 610S-4 and shall consist of a minimum five-foot (1.5 meters) high chain link fencing with tubular steel support poles or "T" posts.

B. Type B Wood Fence (Typical Application-high potential damage): Type B protective fencing shall be installed in accordance with City of Austin Standard Details 610S-3 and 610S-5 and shall consist of any vertical planking attached to 2x4-inch (50 x 100 mm) horizontal stringers which are supported by 2x4-inch (50 x 100 mm) intermediate vertical supports and a 4x4-inch (100 x 100 mm) at every fourth vertical support.

C. Type C Other Materials (Limited Application-minimal potential damage): The following materials may be permitted as alternates for limited or temporary applications (3 days or less) where tree damage potential is minimal:

1. High visibility plastic construction fencing. - The fabric shall be 4 feet (1.2 meters) in width and made of high density polyethylene resin, extruded and stretched to provide a highly visible international orange, non-fading fence. The fabric shall remain flexible from -60oF to 200oF (-16oC to 93oC) and shall be inert to most chemicals and acid. The fabric pattern may vary from diamond to circular with a minimum unit weight of 0.4 lbs./Ft. (0.6 kilograms per meter). The fabric shall have a 4 foot (1.2 meters) width minimum tensile yield strength (Horizontal) of 2000 psi [13.9 megaPascals], ultimate tensile strength of 2680 psi [18.5 megaPascals] (Horizontal) and a maximum opening no greater than 2 inches (50 mm).

2. Other approved equivalent restraining material. - The fencing materials, identified in (a) and (b) above, shall be supported by steel pipe, tee posts, U posts or 2" x 4" (50 mm x 100 mm) timber posts that are a minimum of 5-1/2 feet (1.68 meters) in height and spaced no more than 8 feet (2.44 meters) on centers. The fabric shall be secured to post by bands or wire ties.

2.2 Trunk Protection (Limited Application): When indicated on the Drawings or directed by the Architect, tree trunk protection shall be provided in accordance with City of Austin Standard Details 610S-4 and 610S-5. Tree trunk protection shall consist of any 2 x 4-inch (50 x 100 mm) or 2 x 6-inch (50 x 150 mm) planking or plastic strapping.

2.3 Tree Dressing: Tree dressing of any damaged areas shall be accomplished using any approved asphaltic tree wound paint, immediately after damage occurs.

2.4 Tree Wells for Raised Grades: When existing grades are raised by more than 6 inches (150 mm), the tree root system shall be protected by the installation of tree wells in accordance with City of Austin Standard Detail 610S-6. Native stone, railroad ties or equivalent timber shall be used for the separator wall of the well and PVC conforming to ASTM D-2729, SDR-35 shall be used for the aeration systems in fill areas.

2.5 Permeable Paving (Environmental Criteria Manual Section 3.5.A.1): Permeable segmented pavers in conjunction with PVC pipe aeration system or concrete on gravel base with cored holes shall be used to protect existing tree root zones when indicated on the Drawings or directed by the Architect.

2.6 Fertilizer: Fertilizer shall conform to City of Austin Standard Specification Item No. 606S, "Fertilizer".

PART 3 - EXECUTION

3.1 Protective Fencing: All trees and shrubs in the proximity of the construction site shall be carefully checked for damage prior to initiation of any development activity. All individual trees, shrubs, and natural areas scheduled for preservation shall be protected during construction with temporary fencing as indicated on the Drawings or directed by the Architect. Protective fences shall be installed prior to the start of any site preparation work (clearing, grubbing, or grading), and shall be maintained in functioning condition throughout all phases of the construction project. Protective fence locations in close proximity to intersecting streets or drives shall adhere to the sight distance and desirable sight triangle.

A. Protective fences shall be constructed at the locations (typically the outer limits of the Critical Root Zone) and with materials indicated on the Drawings to prevent the following:
   1. Soil compaction in the root zone area resulting from vehicular traffic or storage of equipment or materials.
   2. Root zone disturbances due to grade changes [greater than 6" (150 mm) cut or fill] or trenching not reviewed and authorized by the Architect.
   3. Damage to exposed roots, trunks or limbs by mechanical equipment.
   4. Other activities detrimental to trees such as chemical storage, concrete truck cleaning, and fires.

3.2 Repair of Damage: Tree roots scarred by equipment shall be cut cleanly and covered with topsoil. When tree roots are pruned, a comparable portion of selected branches shall be cut from the tree on the opposite side. Limb pruning shall be made at the branch collar. All limbs greater than 1 inch (25 mm) in diameter shall be precut in accordance with ANSI 300 pruning methods to prevent splitting. All cut limbs shall be treated with an approved tree dressing. Tools shall be disinfected with alcohol or 5 ppm chlorine solution between repairs to trees to prevent the transmission of diseases from one tree to another. All trees damaged during construction shall receive an application of fertilizer within the drip line conforming to Standard Specification Item No. 606S, "Fertilizer" at the rate of 4 pounds per caliper inch (.07 kilograms per caliper mm).

3.3 Cutting and Filling Around Trees: When the depth of an excavation or embankment exceeds 6 inches (150 mm within the drip line of any tree with a diameter greater than 8 inches (200 mm), a tree well shall be constructed to protect the tree as indicated on the Drawings.

3.4 Paving Around Trees: Where paving within the dripline of any tree greater than a 6 inch (150 mm) diameter is necessary, a permeable pavement and aeration system must be installed as indicated on the Drawings, except for street construction.

3.5 Tree Removal: Any trees which are indicated on the Drawings for removal or which may interfere with the construction shall be removed subject to the approval of the Architect. When a tree or shrub is scheduled for removal, it shall be cut to a depth of 12 inches (300 mm) below the surrounding ground line. After removal, soil shall be placed in the hole to a depth matching the existing grade. The tree shall be cut into sections that can be managed, removed from the site and disposed of. All work shall be conducted in such a manner as to protect all facilities, improvements and vegetation in the work area. All damage resulting from tree removal or pruning shall be repaired at the Contractor's own expense.

3.6 Final Cleanup: All temporary tree and shrub preservation and protection measures shall be removed when the construction has been completed.

01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings Specification or other conditions of the contract, apply to this Section.

1.2 SUMMARY: This Section specifies administrative and procedural requirements for cutting and patching. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.3 SUBMITTALS: Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

A. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.

B. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.

C. List products to be used and firms or entities that will perform Work.

D. Indicate dates when cutting and patching is to be performed.

E. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.

F. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.

G. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

1.4 QUALITY ASSURANCE:

A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load carrying capacity or load deflection ratio.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
   a. Foundation construction.
   b. Bearing and retaining walls.
   c. Structural concrete.
   d. Structural steel.
   e. Lintels.
   f. Structural decking.
   g. Stair systems.
   h. Miscellaneous structural metals.
   i. Equipment supports.
   j. Piping, ductwork, vessels and equipment.

B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
   a. Shoring, bracing, and sheeting.
   b. Primary operational systems and equipment.

c. Air or smoke barriers.
d. Water, moisture, or vapor barriers.
e. Membranes and flashing.
f. Fire protection systems.
g. Noise and vibration control elements and systems.
h. Control systems.
i. Communication systems.
j. Conveying systems.
k. Electrical wiring systems.

1.5 Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

A. If possible retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:

PART 2 - PRODUCTS

2.1 MATERIALS: Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION: Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.3 PERFORMANCE:

A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.

3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.

4. Comply with requirements of applicable Sections of Division 2 where cutting and patching requires excavating and backfilling.

5. By pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by passing and cutting.

C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

3.4 CLEANING: Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

01 77 00 - PROJECT CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 WARRANTY: The Contractor will warranty all equipment, materials & workmanship for a period of at least 1 year after completion, unless the manufacturer or specification provides for a longer warranty period. The Contractor will make prompt repairs or replacement of any defective work detected during that period at no charge to the Owner. Within 30 days prior to the end of this warranty period, the Contractor will either arrange & hold an on-site review of the project with the Architect & Owner's representative or extend his warranty for another 1 year period. All warranty periods begin upon substantial completion.

1.2 RECORD DRAWINGS: Upon completion the Contractor will provide the Owner with two set of record prints with additions & variations shown in red. Remove Architects and Engineers seals from record drawings.

1.3 OPERATING INSTRUCTIONS: On completion, the Owner will be provided with all instructions & warranties in a loose leaf binder, & the Contractor will demonstrate the operation of all equipment. Contractor will record attendance of training sessions with a sign-in sheet and submit to Architect.

1.4 PUNCH LIST COMPLETION: There will be thirty (30) consecutive calendar days allowed to complete punch list items after substantial completion, plus any legitimate time extensions addressed in the general conditions.

1.5 SUBSTANTIAL COMPLETION SUBMISSIONS: Prior to substantial completion inspection, submit all required items, including but not necessarily limited to the following:

A. Written request for inspection (minimum 24hrs prior).
B. Punch list.
C. Final cleaning & touch-up.
D. Excess material stock.
E. Test Reports.
F. No asbestos affidavit.
G. Final Completion Submissions: Prior to final completion, submit all required items, including but not necessarily limited to the following:
H. Completion of punch list items, except as waived by Owner.
I. Written request for final inspection.
J. AIA G706 (Contractor's affidavit of all debts paid).
K. AIA G706A (Contractor's waiver or release of liens).
L. Subcontractor waiver or release of liens.
M. Final application for payment.
N. Removal of temporary facilities.
O. Warranties.
P. Instruction/maintenance manual.
Q. Consent of Surety to final payment.
R. As-built drawings.

1.6 DIGITAL SUBMISSION

A. All closeout documents to be submitted in hardcopy as well as scanned and delivered in pdf format.

B. Include manufacturer’s software as needed.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings Specification or other conditions of the contract, apply to this section.

1.2 SUMMARY: This Section includes the following:

A. Format and content of manuals.

B. Schedule of submittals.

1.3 RELATED SECTIONS

A. 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND OTHER SUBMITTALS

B. 01 45 23 - TESTING AND INSPECTING SERVICES

C. Individual Specifications Sections: Specific requirements for operation and maintenance data.

1.4 QUALITY ASSURANCE: Prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.5 FORMAT

A. Prepare data in the form of an instructional manual.

B. Binders: Commercial quality, 8-1/2 x 11", three D-side ring binders with durable plastic covers; 2" maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

D. Provide tabbed indexed for each separate product and system, with typed description of product and major component parts.

E. Text: Manufacturer's printed data, or typewritten data on 20-lb paper.

F. Drawings:

1. Provide sketches and small drawing up to 11" x 17" in size with reinforced punched binder tab. Bind in with text.

2. Larger drawings to be bound together for each system or product.

G. Contents: Prepare a Table of Contents for each volume, with each Product or system description identified, in three parts as follows:

1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Construction Manager, SubContractor, and major equipment suppliers.

2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by Specification Section. For each category, identify names, addresses, and telephone numbers of SubContractor/ Contractors and suppliers. Identify the following:

a. Significant design criteria.

b. List of equipment.

c. Parts list for each component.

d. Operating instructions.

e. Maintenance instructions for equipment and systems.

f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:

a. Shop drawings and product data.

b. Air and water balance reports.

c. Certificates.

d. Photocopies of warranties and bonds.

1.6 CONTENTS, EACH VOLUME

A. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

B. For Each Product or System: List names, addresses and telephone numbers of SubContractors and suppliers, including local source of supplies and replacement parts.

C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

E. Typed Text: A required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

F. Warranties and Bonds: Bind in copy of each.

1.7 MANUAL FOR MATERIALS AND FINISHES

A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Include manufacturer’s recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional Requirements: As specified in individual Product Specification Sections.

E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

F. The O&M Manual will include all of that O&M data referenced or addressed in divisions 2 to 16 Sections.

1.8 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed or by label machine.

C. Include color-coded wiring diagrams as installed.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include Sequence of Operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide control diagrams by controls manufacturer as installed.

K. Provide Contractor's coordination drawings with color-coded piping diagrams as installed.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Include test and balancing reports.

O. Additional Requirements: As specified in individual Product Specification Sections.

P. Provide a listing in Table of Contents for design data, with tabbed indexed and space for insertion of data.

1.9 SUBMITTALS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 45 days prior to Substantial Completion. This copy will be reviewed and returned (after final inspection), with Architect's comments. Revise content of all document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within ten days after final inspection. Final release of retainage by the Owner is contingent, among other things, upon receipt and review by the Architect of all O&M manuals due the Owner by the Contractor. Final payment will not be made until such time as all manuals have been submitted and approved.

1.10 DIGITAL SUBMISSION

A. All closeout documents to be submitted in hardcopy as well as scanned and delivered in PDF format.

B. Include manufacturer's software as needed.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

01 78 46 - EXTRA STOCK MATERIALS

PART 1 - GENERAL

1.1 GENERAL: The Owner is to be provided extra stock of materials under certain sections of the work. These items will be delivered to the Owner's designated storage facility at the end of the project. Applicable items include the following:

A. SECTION 08 71 00 - DOOR HARDWARE: Furnish 3 dozen extra screws and other fasteners of each size, type and finish used with the hardware items provided. These screws and fasteners are to be delivered to the hardware installer for use during installation. All extra screws and fasteners and all special installation tools furnished with the hardware shall be turned over to the owner at the completion of the job. All installation tools provided by the manufacturers shall be turned over to the owner at the completion of the job.

B. SECTION 09 30 13 - CERAMIC TILING: Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Furnish quantity of full-size units equal to 50 SF of amount installed, for each type, composition, color, pattern, and size indicated.

C. SECTION 09 51 23 - ACOUSTICAL TILE CEILINGS: Deliver to the Owner for his use in future modifications, an extra stock of approximately 200 SF of each type of acoustical material installed, packaging each type of material separately, distinctly marked, and adequately protected against deterioration.

D. SECTION 09 65 19 - RESILIENT TILE FLOORING: Deliver to the Owner for his use in future modifications an extra stock of approximately 100 SF of each color and pattern in each material installed under this Section, packing each type of material separately, distinctly marked, and adequately protected against deterioration.

E. SECTION 09 91 00 - PAINTING: Upon completion of the work of this Section, deliver to the Owner an extra stock equaling 5 gallons of each color, type, and gloss of paint used in the work, tightly sealing each container, and clearly labeling with contents and location where used.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

DIVISION 02 – EXISTING CONDITIONS

02 40 20 - ALTERATION OF EXISTING CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings Specification or other conditions of the contract, apply to this section.

1.2 ALTERATIONS: This Section describes coordination between the demolition, stabilization and restoration, and finishes of the work of this Contract. Cutting, fitting and patching of all existing and new construction as required for the work of all trades is specifically required to be performed by the Contractor, or subcontractor(s) selected by the Contractor as most appropriately responsible for the material or assembly to be altered, as required for the proper execution of the work of all trades. Preparation of existing surfaces to receive finishes to be applied under various Sections of the Specification is described herein. It is the responsibility of the Contractor to ensure that this preparation is properly completed prior to application of finishes under such other Sections.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS: Principal classifications of work related to the work of this Section are specified to be performed under the Sections of the Specifications. Refer to the Sections for description of the extent and nature of the indicated work, and for coordination with related trades. It is the responsibility of the Contractor to fully coordinate the work of this Section with that of all other trades to complete the work contained within the contract documents (contract, contract drawings and specifications).

1.4 INTENT: It is the intent of this Section to require close coordination between operations involving the removal and modification of various portions of the existing structure and operations applying new construction and finishes to the structure. Coordination is required to ensure proper fit between the several parts of the work, without damage to existing construction to remain, resulting in substantial construction and systems that are fully operational in accordance with the Contract Documents. In addition, this coordination is particularly important in this Project for the preservation and restoration of portions of the building having historical significance. This coordination is the responsibility of the General Contractor for this Contract. It is the intent of this Section that to the extent it is inconsistent with any other terms and provisions of the Contract Documents, the Contractor and/or Subcontractors shall provide the better quality or greater quantity of work.

1.5 DEMOLITION: Demolition operations shall be performed under the Demolition Sections, as applicable, subject to provisions herein. Contractor shall be responsible for all shoring, bracing and other support and protection of existing construction and new work required to maintain integrity of existing structure and work in progress during all demolition operations. Include all platforms, barriers, weather protection, lighting, warning signs, and all other means necessary for proper protection of property, personnel, the public and other construction. Designate individuals responsible for the supervision and coordination of this protective work who have appropriate training and experience to whom the Owner, Program Manager and Architect make no objection. Plan and carry out demolition operations with utmost care to prevent excessive vibration, settlement or other structural damage, or damage to existing finish materials to remain. Protect the work against fire, including setting and enforcing safety rules in the operation of welding and cutting torches and other heat-producing equipment and activities, and maintaining fire protection equipment. Consult with the Owner and local fire officials regarding required protection and procedures.

1.6 PREPARATION AND CLEANING OF EXISTING SURFACES: Prepare and clean existing surfaces to remain as required for installation of new materials, equipment and finishes specified in other specification sections. For all surfaces scheduled or otherwise indicated to be refinished, clean off materials such as old paint, rust, adhesive, dirt, oil, wax, sealers and all other materials that would prevent proper adhesion of new finish materials, or would bleed through, texture or otherwise adversely affect the new finish. Clean existing surfaces to receive new finishes thoroughly, removing all soilage and applied material, of whatever nature, that would impair bond of new finish to such surface, or would show through new finishes as a different color or texture than other surfaces of the same type. Use scrapers, brushes, sanding, wire pads, detergents, chemical cleaning solutions, solvents, light sand blasting, or other materials and equipment appropriate for surfaces being cleaned. Use all materials in strict conformance to the manufacturer's instructions and recommendations. Dispose of all cleaning solutions and/or solvents in accordance with applicable law. Maintain Material Safety Data Sheets (MSDS) onsite for all products being used onsite in accordance with OSHA regulations. Surfaces to receive paint finishes shall be cleaned to meet requirements of paint materials applied, and shall be smooth and even in appearance and to touch. Sand and feather all paint edges to eliminate visible layering or chipping related to multiple coats of paint. It is not required that all adherent paint or other existing finish be removed completely, so long as surfaces are in proper condition to receive new finish to satisfaction of the Architect.

A. Submit proposed cleaning materials, and methods proposed for their use, to Architect for review before proceeding. Clean test areas for Architect's review before proceeding with complete cleaning operations.

B. After cleaning is completed, brush or rinse surfaces to remove cleaning agents or residue, and leave surfaces ready for installation of new finishes.

C. In addition to preparation work specified above, clean existing finished surfaces that will remain exposed-to-view and unaltered in the finished work.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE

PART 3 - EXECUTION

3.1 NOT APPLICABLE

02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY: This Section includes the following:

A. Demolition and removal of selected portions of a building.

B. Demolition and removal of selected site elements.

C. Patching and repairs.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.4 MATERIALS OWNERSHIP: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1.5 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections, for information only, unless otherwise indicated.

B. Proposed dust-control measures.

C. Proposed noise-control measures.

D. Schedule of selective demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.

2. Interruption of utility services.

3. Coordination for shutoff, capping, and continuation of utility services.

4. Use of elevator and stairs.

5. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.

6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

7. Locations of temporary partitions and means of egress.

E. Inventory of items to be removed and salvaged.

F. Inventory of items to be removed by Owner.

G. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by selective demolition operations.

1.6 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition Work similar to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before starting selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 PROJECT CONDITIONS

A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Owner assumes no responsibility for actual condition of buildings to be selectively demolished. Conditions existing at time of inspection for proposal purpose will be maintained by Owner as far as practical.

C. Asbestos: It is not expected that asbestos will be encountered in the Work. If any materials suspected of containing asbestos are encountered, do not disturb the materials. Immediately notify the Architect and the Owner. Asbestos will be removed by Owner before start of Work.

D. Storage or sale of removed items or materials on-site will not be permitted.

1.8 SCHEDULING: Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

1.9 WARRANTY: Existing Special Warranty: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS: use repair materials identical to existing materials.

A. Where identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

B. Use materials whose installed performance equals or surpasses that of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

E. Survey the condition of the building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of the structure or adjacent structures during selective demolition.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

A. Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.

B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services serving building to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.

2. Where utility services are required to be removed, relocated, or abandoned, provide bypass connections to maintain continuity of service to other parts of the building before proceeding with selective demolition.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal the remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.

2. Protect existing site improvements, appurtenances, and landscaping to remain.

3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.

4. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.

5. Protect walls, ceilings, floors, and other existing finish work that are to remain and are exposed during selective demolition operations.

6. Cover and protect furniture, furnishings, and equipment that have not been removed.

D. Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

E. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of building to be selectively demolished. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION

A. Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition work above each floor or tier before disturbing supporting members on lower levels.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

5. Maintain adequate ventilation when using cutting torches.

6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

8. Locate selective demolition equipment throughout the structure and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

9. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.

10. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain, using power-driven masonry saw or hand tools; do not use power-driven impact tools.

C. Remove resilient floor coverings and adhesive according to recommendations of the Resilient Floor Covering Institute's (RFCI) "Recommended Work Practices for the Removal of Resilient Floor Coverings" and Addendum.

D. Remove air-conditioning equipment without releasing refrigerants.

3.5 PATCHING AND REPAIRS

A. Promptly patch and repair holes and damaged surfaces caused to adjacent construction by selective demolition operations.

B. Patching is specified in Division 1 Section "Cutting and Patching."

3.6 CLEANING

A. Sweep the building broom clean on completion of selective demolition operation.

B. Change filters on air-handling equipment on completion of selective demolition operations.

DIVISION 03 – CONCRETE

03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION: Furnish all labor, materials, tools, & equipment as required for Concrete Formwork & Accessories, as shown on the Drawings, specified herein, and as needed for a complete and proper installation. Forms shall be used, wherever necessary, to confine the concrete and shape it to the required dimensions.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section. All work will comply with The American Concrete Institute, ACI 301-84, "Specifications for Structural Concrete" & ACI-318, latest edition.

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

PART 2 - PRODUCTS

2.1 FORM ACCESSORIES: Form accessories to be partially or wholly embedded in the concrete, such as ties and hangers, shall be of a commercially manufactured type.

2.2 CONSTRUCTION JOINTS: Joints not indicated on the contract documents shall be located and constructed to minimize the impact on the strength of the structure. Joint types and locations shall be submitted to the architect/engineer. All reinforcement shall be continued across joints. Longitudinal keys at least 1 1/2 in. deep shall be provided in all joints.

2.3 EXPANSION JOINTS: Reinforcement or other embedded metal items bonded to the concrete (except dowels in floors bonded on only one side of joints) shall not be permitted to extend continuously through any expansion joint. Pre-molded expansion joint filler shall be of the type required by the contract documents and shall conform to ASTM D 994, ASTM D 1751 or ASTM D 1752.

2.4 OTHER EMBEDDED ITEMS: All sleeves, inserts, anchors, and embedded items required for adjoining work or for its support shall be placed prior to concreting. All contractors whose work is related to the concrete or must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.

PART 3 - EXECUTION

3.1 DESIGN AND INSTALLATION OF FORMWORK: The design and engineering of the formwork, as well as its construction, shall be the responsibility of the contractor. Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete, and shall have sufficient rigidity to maintain specified tolerances. The formwork shall be designed for loads and lateral pressure and for design considerations, wind loads, allowable stresses, and other applicable requirements of the controlling local building code. The maximum deflection of facing materials reflected in concrete surfaces exposed to view shall be 1/240 of the span between structural members. Forms shall be sufficiently tight to prevent loss of mortar from the concrete. To maintain the specified tolerances, the formwork shall be cambered to compensate for anticipated deflections in the formwork prior to hardening of the concrete. Forms shall be securely braced against lateral deflections. Earth cuts shall not be used as forms for exposed vertical location surfaces unless required or permitted. Only exposed surfaces need be formed.

3.2 TOLERANCES: Unless otherwise specified by the architect/engineer, formwork shall be constructed so that the concrete surfaces will conform to the tolerance limits indicated.

A. Variation from plumb and level: 1/4" in 20'; 1/2" max.
B. Variation of building lines: 1/2" in 20'; 1" max.
C. Variation in openings: +/- 1/4"
D. Variation in thickness: +/- 1/4"
E. Variations in footing plan dim: -1/2in. +2in.
F. Footing eccentricity: 2% width, 2" max.
G. Footing thickness:-5% + No limit

3.3 PREPARATION OF FORM SURFACES: All surfaces of forms and embedded materials shall be cleaned of all accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed. Before placing the reinforcing steel or the concrete, the surfaces of the forms shall be covered with an acceptable coating material that will prevent bond with the concrete, and not stain the concrete surfaces. Excess form coating material shall not stand in puddles in the forms nor shall come in contact with hardened concrete against which fresh concrete is to be placed.

3.4 REMOVAL OF FORMS: Formwork for columns, walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage form removal operations. Forms used to support the weight of concrete shall remain in place until the concrete has reached the minimum strength specified.

3.5 PLACING EMBEDDED ITEMS: Embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

03 15 20 - EXPANSION AND CONTRACTION JOINTS

PART 1 - GENERAL

1.1 DESCRIPTION: Included under this section will be all labor, materials, tools, & equipment as required for expansion & contraction joints in concrete work, as shown on the Drawings, specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section. All work will comply with The American Concrete Institute, ACI 301-84, "Specifications for Structural Concrete" & ACI-318, latest edition.

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

PART 2 - PRODUCTS

2.1 FIBER EXPANSION JOINTS: Fiber Expansion Joints to be manufactured commercial type meeting requirements of ASTM D 1751-73 (1978), "Specifications for Preformed Expansion Joint Fillers for Concrete Paving & Structural Construction (Non-extruding) & Resilient Bituminous Type" 1/2 inch thick unless indicated differently on Drawings.

2.2 OTHER MATERIALS: Furnish and install any supplementary materials, whether or not specifically indicated, required for a complete and proper installation, as selected by the Contractor subject to the acceptance of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION: Place at sidewalks, at juncture of concrete & structures, as indicated on plans, & necessary for adequate expansion control. Steel reinforcement thru expansion joints to be sleeved on one end. Locate slab control joints as indicated or customarily required.

03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 DESCRIPTION: Included under this section will be all labor, materials, tools, & equipment as required for structural concrete reinforcement, as shown on the Drawings, specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section. All work will comply with The American Concrete Institute, ACI 301-84, "Specifications for Structural Concrete" & ACI-318, latest edition. Words and terms used in these specifications are defined in Cement and Concrete Terminology, ACI 116R. Applicable standards of the American Society for Testing Materials referred to in these specifications are declared to be a part of these specifications, the same as if fully set forth herein, including ASTM-615.

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

PART 2 - PRODUCTS

2.1 BAR MATS: Bar mats shall be of the clipped type conforming to ASTM A 184 and shall be fabricated from reinforcing bars.

2.2 WIRE: Wire shall be smooth or deformed wire as indicated on the contract documents. Smooth wire shall conform to ASTM A 82. Deformed wire shall conform to ASTM A 496, size D4 and larger. Spirals may be fabricated form reinforcing bars or wire.

2.3 WIRE BAR SUPPORTS: Provide wire supports or CSRI block supports. Unless otherwise specified or permitted, wire bar supports shall be in accordance with Class 1, maximum protection, or Class 2, moderate protection in Chapter 3 of Manual of Standard Practice by the Concrete Reinforcing Steel Institute.

2.4 REINFORCING BARS: All but No. 2 bars shall be deformed type. Rebars #4 & above to have grade identification marks and conform to ASTM A 615-82, "Specifications for Deformed & Plain Billet-Steel Bars for Concrete Reinforcing", Grade 60.

PART 3 - EXECUTION

3.1 GENERAL: Fabricate and place reinforcing steel according to latest edition of ACI "Manual of Standard Practice for Detailing Reinforced Concrete Structures", The American Concrete Institute ACI 301-84, "Specifications for Structural Concrete", and details on Drawings.

3.2 WELDING: When required or permitted, all welding of reinforcing bars shall conform to AWS D1.4. Unless otherwise accepted, welding of crossing bars (tack welding) for assembly of reinforcement is prohibited.

3.3 FABRICATION: All reinforcement shall be bent cold unless otherwise permitted. Reinforcing bars shall be fabricated in accordance with the standard of fabricating tolerances ACI 315. When it is necessary to move bars to avoid interference with other reinforcement, conduits, or embedded items exceeding the specified placing tolerances, the resulting arrangement of bars shall be subject to acceptance. Reinforcement shall be placed to the following tolerance:

Bar to surface	+ or - 1/4"
Bar to bar	+ or - 2"
Stirrups	+ or - 1"

3.4 PLACING: All reinforcement, at the time concrete is placed, shall be free of mud, oil, or other materials that may adversely affect or reduce the bond. Reinforcement with rust, mill scale, or a combination of both shall be considered satisfactory provided the minimum dimensions, weight, and height of deformations of a hand-wire-brushed test specimen are not less than the applicable ASTM specification requirements.

3.5 SUPPORT: All reinforcement shall be supported and fastened before concrete is placed and shall be secured against displacement within tolerances. Unless otherwise indicated in the contract documents reinforcement supported from the ground or mud mat shall rest on precast concrete blocks no less than 4 sq. in. and having a compressive strength equal to or greater than the specified compressive strength of the concrete being placed. Other means of support may be used if accepted.

Reinforcement supported from formwork shall rest on bar supports made of concrete, metal, plastic, or other acceptable materials. Where the concrete surface will be exposed to the weather in the finished structure, the portions of all bar supports within 1/2in. of the concrete surface shall be noncorrosive or protected against corrosion.

3.6 BENDING: Bending or straightening of bars partially embedded in concrete shall not be permitted except when specifically accepted. The minimum inside bend diameters shall conform to the following unless otherwise permitted. In addition, the beginning of the bend shall not be closer to the concrete surface than the minimum diameter of bend. No. 4 through No. 5 bars may be cold bent the first time if temperature is above 32 degrees F; Preheating is required for subsequent straightening or bending. For No. 6 and larger preheating is required. Preheating prior to bending or straightening, when required, shall be in accordance with ACI requirements.

A. Minimum Diameter of Bends

Bar size	Minimum diameter
# 3 - 8	6 bar diameters
# 9, 10, & 11	8 bar diameters
# 14 & 18	10 bar diameters

03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION: Included under this section will be all labor, materials, tools, & equipment as required for CAST-IN-PLACE CONCRETE, as shown on the Drawings, specified herein, and as needed for a complete and proper installation. Concrete for all parts of the work shall be of the specified quality and capable of being placed without excessive segregation. When hardened, concrete shall develop all characteristics required by the contract documents.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

1.4 REFERENCE STANDARDS: The standards of the American Society for Testing Materials referred to in these specifications are declared to be a part of these specifications, the same as if fully set forth herein. All work will comply with The American Concrete Institute, ACI 301-84, "Specifications for Structural Concrete" & by reference is a part of this specification. Words and terms used in these specifications are defined in Cement and Concrete Terminology, ACI 116R.

1.5 TESTING: Concrete materials and operations will be tested and inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the architect-engineer for final acceptance. Testing agency shall meet the requirements of ASTM E 329. The agency shall report all test and inspection results to the architect or engineer and the contractor immediately after they are performed. Make at least one strength test for each 50 cu. yd, or fraction thereof, of each mixture design of concrete placed in any 1 day. When the total quantity of concrete with a given mixture design is less than 50 cu. yd, the strength tests may be waived by the architect/engineer. Mold and cure three specimens form each sample in accordance with ASTM C 341. One specimen shall be tested at 28 days for acceptance, one shall be tested at 7 days for information, & one shall be held for record. The following testing services shall be performed by the designated agency:

A. Review the contractor's proposed materials & mix for compliance with the specification.
B. Conduct strength tests of the concrete during construction in accordance with ASTM procedures.
C. Determine slump of the concrete sample for each strength test and whenever consistency of concrete appears to vary, using ASTM C 143.
D. Additional testing and inspection required because of changes in materials or proportions requested by the contractor, or by their failure by test or inspection to meet specification requirements.

PART 2 - PRODUCTS

2.1 CEMENTS: Cement shall Portland cements, ASTM C 150, type I. Use one brand of cement throughout, unless approved otherwise by the Engineer.

2.2 ADMIXTURES: Admixtures to be used in concrete, when required or permitted, shall conform to the following appropriate specifications: Air-entraining admixtures, ASTM C 260; Water-reducing, retarding, and accelerating admixtures, ASTM C 494; Pozzolanic admixtures, ASTM C 618. Admixtures used in the work shall be of the same composition as those used in establishing the concrete proportions. All admixtures shall be used in accordance with the manufacturer's instructions except as otherwise specified. Flyash may be used as approved by the structural engineer.

2.3 WATER: Mixing water for concrete shall meet requirements of ASTM C 94.

2.4 AGGREGATES: Aggregates for normal weight concrete shall meet the requirements of ASTM C 33. Aggregates for lightweight concrete shall meet the requirements of ASTM C 330. Fine and coarse aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as the combination of sizes when two or more are used, shall meet the appropriate grading requirements of the applicable ASTM specifications.

2.5 STORAGE OF MATERIALS: Cement shall be stored in weather-tight containers. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates. Stockpiles of natural or manufactured sand shall be allowed to drain to insure relatively uniform moisture content

throughout the stockpile. Admixtures shall be stored in a manner that will avoid contamination, evaporation, or damage. Agitating equipment shall be provided as required. Liquid admixtures shall be protected from temperature which would adversely affect their characteristics.

2.6 SLUMP: Unless otherwise permitted or specified, the concrete shall be proportioned and produced to have a slump of 4 in. or less if consolidation is to be by vibration, and 5 in. or less if consolidation is to be by methods other than vibration. A tolerance of up to 1 in. above the maximum indicated shall be allowed for one batch in any five consecutive batches tested. Concrete of lower than usual slump may be used provided it is properly placed and consolidated. The slump shall be determined by ASTM C 143.

2.7 MAXIMUM SIZE OF COARSE AGGREGATE: The nominal maximum size of the aggregate shall not be more than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear spacing between reinforcing bars. These limitations may be waived if, in the judgment of the architect/ engineer, workability and methods of consolidation are such that the concrete can be placed without honeycomb or voids. See ASTM C 33 for tolerances on oversize for various nominal maximum size designations.

2.8 DURABILITY: Concrete of normal weight which will be subject to potentially destructive exposure (other than wear or loading) such as freezing and thawing, severe weathering or deicer chemicals shall be air-entrained per ACI requirements. Measurement of air content shall meet the requirements of ASTM C 231, C 173, or C 138. The water-cement ratio shall not exceed 0.47 by weight. Proportions shall be selected to provide a specified strength of 3000 psi or more.

2.9 VAPOR BARRIER: Provide under-slab vapor barrier as indicated in Section 07260, as approved by Architect.

PART 3 - EXECUTION

3.1 PROPORTIONING: Proposed concrete proportions shall be subject to acceptance by the architect/engineer based on demonstrated ability to produce concrete meeting all requirements of the specification. Proportions of materials for concrete shall be established to provide: (a)Adequate workability and proper consistency to permit concrete to be worked readily into the forms and around reinforcement without excessive segregation or bleeding under conditions of placement to be employed, (b)Resistance to freezing and thawing and other aggressive actions, (c)Conformance with ACI strength test requirements. Concrete proportions shall be established on the basis of previous field experience or laboratory trial batches per ACI requirements. Maximum permissible water cement ratio by weight shall be 0.47 for slab-on-grade. Proportions shall be selected to provide 3000 psi 28 day strength and provide a minimum of 5 sacks of cement per cubic yard of concrete; the required compressive strength at 3 days shall be 2250 psi.

3.2 PREPARATION BEFORE PLACING: Formwork shall be completed; snow, ice and water shall be removed; reinforcement shall be secured in place; expansion joint material, anchors, and other embedded items shall be positioned; and the entire preparation shall be accepted. Semiporous subgrades shall be sprinkled sufficiently to eliminate suction and porous subgrades shall be sealed in an acceptable manner.

3.3 VAPOR BARRIER: In building, vapor barrier to be in place with any penetrations or tears sealed watertight; lap min 6" & pin. At any wood flooring areas, provide double stregth material.

3.4 PREPARATION OF SUBGRADE FOR SLABS ON GROUND: The subgrade shall be well drained and of adequate and uniform loadbearing capacity. The minimum in-place density of the subgrade soils shall be as required in the specifications. The bottom of an undrained granular base course shall not be lower than the adjacent finished grade. The subgrade shall be moist, but there shall be no standing water nor any muddy or soft spots when the concrete is placed. Concrete shall not be placed on frozen ground.

3.5 EDGE FORMS AND SCREEDS: Edge forms and intermediate screed strips shall be set accurately to produce the designated elevations and contours of the finished surface, and shall be sufficiently strong to support vibrating screeds or roller pipe screeds if the nature of the such equipment. The concrete surface shall be aligned to the contours of screed strips by the use of strike-off templates or acceptable compacting type screeds.

3.6 CONVEYING: Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by the methods which will prevent segregation or loss of ingredients and in a manner which will assure that the required quality of the concrete is maintained.

3.7 DEPOSITING: Concrete shall be deposited continuously, or in layers of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, construction joints shall be located as indicated on the contractor documents or as permitted. Placing shall be carried on at such a rate that the concrete which is being integrated with fresh concrete is still plastic. Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited. Temporary spreaders in forms shall be removed which the concrete placing has reached an elevation rendering their service unnecessary.

3.8 SEGREGATION: Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to any procedure which will cause segregation.

3.9 CONSOLIDATION: All concrete shall be consolidated by vibration, spading, rodding or forking so that the concrete is thoroughly worked around the reinforcement, around embedded items, and into corners of forms, eliminating all air or stone pockets which may cause honey-combing, pitting, or planes of weakness. Internal vibrators used shall be the largest size and the most powerful that can be properly used in the work, as described in Table 5.1.4 of ACI 309. They shall be operated by competent workmen. Use of vibrators to transport concrete within forms shall not be points approximately 18 in. apart. At each insertion, the duration shall be sufficient to cause segregation, generally from 5 to 15 sec.

3.10 JOINTING: Joints in slabs on grade shall be located and detailed as indicated in the contract documents. If saw-cut joints are required or permitted, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent aggregates being dislodged by the saw. Cutting shall be completed before shrinkage stresses become sufficient to produce means.

3.11 FINISHES:

A. Floated finish - After the concrete has been placed, consolidated, struck off, and leveled the concrete shall not be worked further until ready for floating. Floating with a hand float or with a bladed power trowel equipped with float shoes, or with a powered disc float shall begin when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation. During or after the first floating, planeness of surface shall be checked with a 10-ft straightedge applied at not less than two different angles. All high spots shall be cut down and all low spots filled during this procedure to produce a surface within Class B tolerance throughout. The slab shall then be refloated immediately to a uniform sandy texture. Unless noted otherwise provide at: interior exposed concrete flooring at damp locations.

B. Troweled finish - The surface shall first be float-finished as specified. It shall next be power troweled, and finally hand troweled. The first troweling after power floating shall produce smooth surface which relatively free of defects but which show some trowel marks. Additional trowelings shall be done by hand after the surface has hardened sufficiently. The final troweling shall be done when the ringing sound is produced as the trowel is moved over the surface. The surface shall be thoroughly consolidated by the hand troweling operations. The finished surface shall be essentially free of trowel marks, uniform in texture and appearance and shall be plane to a Class A tolerance, except tolerance for concrete on metal deck shall be Class B. On surfaces intended to support floor coverings, any defects of sufficient magnitude to show through the floor covering shall be removed by grinding. Unless noted otherwise provide at: all interior floor areas except as required in (a).

3.12 FINISHING TOLERANCES: Per ACI 117, interior finishes (except as noted otherwise) to have Flatness (FF) of 20 & Levelness (FL) of 17, with no more than 0.31" deviation in 10'-0", as determined by a 10-ft straightedge placed anywhere on the slab in any direction. At wood gym floor areas provide FF of 35 and an FL of 30.

3.13 PROTECTION: Unless adequate protection is provided and acceptance is obtained, concrete shall not be placed during rain, sleet, or snow. Rainwater shall not be allowed to increase the mixing water nor to damage the surface finish. When the temperature of the surrounding air is expected to be below 40 degrees F during placing or within 24 hr thereafter, the temperature of the plastic concrete, as placed, shall be no lower than 55 degrees F for sections less than 12 in. in any dimension not 50 degrees F for any other sections. The temperature of the concrete as placed shall not be so high as to cause difficulty from loss of slump, flash set, or cold joints and should not exceed 90 degrees F. When the temperature of the concrete exceeds 90 degrees F, precautionary measures acceptable to the architect/engineer shall be put into effect. When the temperature of the steel is greater than 120 degrees F steel forms and reinforcement shall be sprayed with water just prior to placing the concrete.

3.14 BONDING: The hardened concrete of construction joints shall be dampened immediately prior to placing of fresh concrete. The hardened concrete of horizontal construction joints shall be dampened (but not saturated) and then thoroughly covered with a coat

of cement grout of similar proportions to the mortar in the concrete. The fresh concrete shall be placed before the grout has attained its initial set. Joints receiving an adhesive or retarder shall be prepared and applied in accordance with the manufacturer's recommendations.

3.15 REPAIR OF DEFECTIVE AREAS: All honeycombed and other defective concrete shall be removed down to sound concrete. If chipping is necessary the edges shall be perpendicular to the surface or slightly undercut. No featheredges will be permitted. The area to be patched shall be dampened & a bonding grout shall be applied. Produce a color matching color of the surrounding concrete. Keep damp for 7 days.

3.16 FINISHING OF FORMED SURFACES: For all concrete surfaces exposed to public view smooth rubbed finish is to be applied. Surfaces shall be wetted and rubbed with carborundum brick or other abrasive until uniform color and texture are produced.

3.17 CURING AND PROTECTION: Beginning immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures, and mechanical injury, and shall be maintained with minimal moisture loss at a relatively constant temperature for the period necessary for hydration of the cement and hardening of the concrete. The materials and methods of curing shall be subject to acceptance. If used, curing compound to conform to ASTM C 309. Curing shall be continued for at least 7 days except high-early-strength concrete (3 days). The temperature of the concrete shall be maintained above 50 degrees. During the curing period, the concrete shall be protected from damaging mechanical disturbances.

3.18 ACCEPTANCE OF STRUCTURE: Acceptance of structure will be in accordance to ACI requirements.

03 48 00 - PRECAST CONCRETE SPECIALTES

PART 1 - GENERAL

1.1 DESCRIPTION: Furnish all labor, materials, tools, & equipment as required for Misc. Sitework Items, as shown on the Drawings, specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

1.4 GEOTECHNICAL REPORT: At a minimum, comply with all requirements of the geotechnical report.

1.5 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

PART 2 - PRODUCTS

2.1 SPLASH BLOCKS: Pre-cast concrete splash blocks extending 4' from building perimeter. Located at each downspout to grade & slope away from building so as to direct water away from foundation. Accepted manufacturer's are as follows:

A. H & R Concrete Co., Inc.
B. Fort Collins Pre-Cast, Inc.
C. Copeland Enterprises, Inc.

2.2 PRECAST WHEEL STOPS: 6'x6"x6" precast concrete wheel stop, anchored with 2-36" steel stakes. Provide one at at each new parking space.

PART 3 - EXECUTION

3.1 PREPARATION: Examine the areas and conditions under which work of this Section will be performed. Correct condition detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION: Install this work in strict accordance with the original design, and the manufacturer's recommendations as accepted by the Architect. Protect work during storage, installation & until final acceptance, replacing any damaged material.

3.3 SPLASH BLOCKS: Place splash blocks on compacted gravel base with a 5% slope away from building. Install 8 SF minimum of Bermuda sod at outflow of each splash block, securely attach & maintain until established.

DIVISION 04 – MASONRY

04 05 16 - MASONRY GROUTING

PART 1 - GENERAL

1.1 DESCRIPTION: This section covers the furnishings and placing of grout for masonry construction. ACI 531.1-76-1983 Specification for Concrete Masonry Construction, & ASTM C 476-71 Specification for Mortar and Grout for Masonry, by reference are part of this specification as if attached hereto.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

PART 2 - PRODUCTS

2.1 GROUT: Use grout conforming with ASTM C 476. Mix grout with sufficient water to give a fluid pouring consistency without segregation of materials.

2.2 ADMIXTURES - Admixtures may be used when accepted by Architect.

2.3 WATER - Use potable water.

2.4 COLOR - As selected by Architect.

PART 3 - EXECUTION

3.1 PREPARATION: Set reinforcing steel and anchors in required position and secure against displacement before grouting is started. Mix all cementitious materials and aggregates for a minimum period of 5 min after all materials are placed in the mixer, with the amount of water required to produce the desired consistency.

3.2 GROUT PLACEMENT: Place in cores and/or collar joints while fluid and before initial set has taken place. Puddle or vibrate grout into place. Place grout in such a way as to prevent segregation of materials. Pour grout fluid enough to flow into all crevices of grout spaces leaving no voids. Grout beams over openings in one continuous operation. Grout vertical cores in maximum of 5 ft lifts. Stop grout pours 1 1/2 in. below a mortar joint, except at top of wall. Where bond beams are used stop grout pour 1/2 in. below top. Use metal lath, mortar, or special units to confine grout to area required.

3.3 PRECAUTIONS: Do not use materials which may inhibit bond or are combustible. Use acceptable cold weather precautions in placing and curing of grout when temperature is less than 32 degrees F. In hollow unit masonry construction, limit low-lift grouting to maximum wall height of 5 ft per lift. Vertical cores to be grouted shall have minimum clear dimension between sides of of the core of 2 in. and clear area of 8 sq in. Do not permit water or foreign material to fall in grout space while grout is being placed and curing. Remove misplaced grout immediately & clean affected areas.

04 05 19 - MASONRY ANCHORAGE AND REINFORCING

PART 1 - GENERAL

1.1 DESCRIPTION: This section covers the furnishing and placing of reinforcement, anchors, ties, and metal accessories for masonry construction. Protect reinforcement, anchors, and ties from contact with soil and from distortion.

1.2 RELATED DOCUMENTS: ACI 531.1-76, 1983, Specification for Concrete Masonry Construction, by reference is a part of this specification as if attached hereto. The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

PART 2 - PRODUCTS

2.1 GENERAL: As applicable, pre-fabricated items shall be manufactured by Dur-O-Wall, or other products determined by the Architect to be equal & receiving his prior approval.

2.2 JOINT REINFORCEMENT: Use cold-drawn steel wire, ASTM A 82 cold-drawn steel wire may be deformed in the process of manufacturing joint reinforcement, or Deformed steel wire, ASTM A 496.

2.3 METAL COATING: Coat joint reinforcement, anchors, ties with either: galvanized coating for wire conforming to ASTM A 641, class 1 for wire entirely embedded in mortar of grout, Class 3 for all other wire; Copper cladding of wire conforming to the requirements as specified for Grade 30 HS wire ASTM B 227; or Zinc coating conforming to ASTM A 153.

2.4 FABRICATION: Fabricate bars without damaging the materials. Bars larger than #5 shall not be field bent unless acceptable. The diameter of bend measured on the inside of the bar, other than for stirrups, for Grade 40 bars in sizes #3 to #11 inclusive, with turns not exceeding 180 deg, the minimum diameter shall be five bar diameters. Inside diameter of bend for stirrups shall not be less than four bar diameters. Standard hooks use a 180 deg turn plus extension of at least four bar diameters but not less than 2 1/2 in. at free end of bar.

2.5 JOINT REINFORCEMENT: Reinforcement of two or more deformed longitudinal wires weld connected with cross wires, forming a truss or ladder design. Use wire not less than D-2 or W-2 nor greater than one-half the mortar joint thickness. Make out-to-cut spacing of longitudinal wires 2 in. less than the nominal width of the wall or wythe. Space welded contacts or cross wires with each longitudinal wire not more than 16 in. Provide joint reinforcement in flat sections 10 to 20 ft long, except that factory-formed corner reinforcements and other special shapes may be shorter.

2.6 ADJUSTABLE WALL ANCHORS: Equal to Durawall DA213, set in, & anchored thru, mastic or approved waterproof membrane material.

2.7 MISC. ANCHORS AND TIES: Fabricate anchors and ties in one of the following ways: Wire mesh ties shall be No. 16 gage minimum 1/2 in. mesh steel wire, 12 in. minimum length and 1 1/2 in. less than the nominal width of wall; Rigid steel anchors at intersecting walls shall be 1 1/2 x 24 in. minimum length, formed in rectangular shape 4 in. wide for hollow units placed with cells vertical and U or Z shape for solid units. End of ties shall be bent at 90 deg with at least 2-in. extension. Material shall conform to ASTM A112 with Class C coating or A82 or A496 with equivalent coating; Corrugated or crimped metal ties shall be sheet 0.03 in. minimum thickness, 1 in. wide, and turned up 1/4 in. at outer end.

2.8 REINFORCING BARS: Use required grade of deformed bars conforming to one of the following, except bars larger than number 11 shall not be used. Billet Steel Bars: ASTM A615 plus supplement #1. Low-Alloy-bars: ASTM A706.

PART 3 - EXECUTION

3.1 PREPARATION: Place all reinforcement for masonry in accordance with project documents. Use metal reinforcement at time of placement which is free of mud, oil, or other coatings that adversely affect bonding capacity. Metal reinforcement with rust, mill scale, or a combination of both may be used provided the minimum dimensions, including height of deformations, and weight of wire brushed specimens are not less than required by applicable ASTM specification. Do not use metal reinforcement with kinks or un-required bends. Do not straighten nor repair bars in a manner that will damage the bar or adjacent construction.

3.2 PLACING REINFORCING BARS: Make splices in bars as shown on project drawings unless otherwise accepted. Provide clear distance between horizontal bars in a layer not less than the diameter of the bars, nor 1 in. except that they may be bundled in pairs. Provide clear distance between vertical bars not less than one and one-half times the bar diameter, not 1 1/2 in. except that they may be bundled in pairs. Lay horizontal bars as work progresses. Hold vertical bars in hollow unit masonry in place at 192 bar diameters or 10 ft maximum on center whichever is lesser. Embed bars in grout and provide a minimum masonry cover not less than the following:

A. Minimum 3 in. from the bottom of masonry footings.
B. Minimum 2 in. where exposed to earth or weather.
C. Minimum 1 1/2 in. where not exposed to earth or weather.

3.3 PLACING JOINT REINFORCEMENT: Place masonry joint reinforcement so the longitudinal wires are located over face-shell mortar beds and are embedded in mortar or grout for their entire length with minimum cover of 5/8 in. when exposed to weather or earth and 1/2 in. at other locations. Place factory-fabricated sections at corners and wall intersections, unless other wise accepted. Extend joint reinforcement at openings not less than 24 in. beyond the end of the sills or lintels or to the end of the panel is less than 24 in. Joint reinforcement shall not be continuous through a control joint or an expansion joint. Lap the ends of joint reinforcement 6 in. for deformed wire and 12 in. for plain wire when spliced. In multi-wythe high lift grouted construction make horizontal wire ties as stirrups 4 in. wide minimum and 2 in. shorter than the overall wall thickness with the wire ends meeting in the center of one embedded end of the stirrup, unless otherwise accepted.

3.4 PLACING ANCHORS, TIES, AND METAL ACCESSORIES: Install required anchors, ties, and metal accessories as the masonry construction progresses. Install mastic or approved waterproof membrane material between anchor & wall to provide a waterproof barrier at penetrations. Set bolts and inserts vertically in the top of walls, pilasters, beams or columns 3 in. minimum from face in masonry 7 in. or more in thickness, and at the center line in thinner masonry sections. Adjust shelf angles as required to keep the masonry level and at required elevation. Provide anchorage as detailed in the project documents or as required for structural performance. Hold all metal accessories to masonry by firmly embedding anchorage into grout or mortar 3 in. minimum. Place pipe sleeves as specified or shown on drawings and solidly grout or mortar in place.

3.5 SPACING: As a minimum, typical vertical reinforcement in CMU to be either #4 at 4'OC or #5 at 6'OC; also locate at all corners & beside all openings. Bond beams to be located at the top of all walls & be #5 bar minimum. Provide any additional reinforcement shown on drawings.

04 05 23 - MASONRY CAVITY DRAINAGE, WEEPHOLES, AND VENTS

PART 1 - GENERAL

1.1 DESCRIPTION: This section covers the furnishing and placing of moisture weeps and mortar dropping protection for masonry construction.

1.2 RELATED DOCUMENTS: ACI 531.1-76, 1983, Specification for Concrete Masonry Construction, by reference is a part of this specification as if attached hereto. The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

PART 2 - PRODUCTS

2.1 WEEP PROTECTION: Non-woven mesh weep vents, equal to Mortar Net Solutions "WeepVent" or Weep Vents by CavClear, for masonry cavity walls. Color to be selected by Architect to match mortar.

2.2 MORTAR DROPPINGS PROTECTION: Provide high density polyethylene or nylon mesh designed to allow moisture to flow downward in the cavity or collar joint to masonry flashing and weeps and hence to the exterior. Drainage system to be continuous at the base of the wall. 1", 0.875", & 0.4" thick x 10" height x 50' length (nominal sizes). Equal to Equal to "Mortar Net" by Mortar Net Solutions or "MortarStop" by Polytite Manufacturing Corporation.

PART 3 - EXECUTION

3.1 WEEP PROTECTION: Provide Weep Vents at head and base of wall at 24" O.C. to ensure cavity ventilation. Leave the side of the masonry units forming the vent space unbuttered and clear of mortar. Slide vent material into joint as the two masonry units forming the weep vent are placed.

3.2 MORTAR DROPPINGS PROTECTION:

A. Manufacturer's Instructions: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

B. Examination:

1. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

2. Match product size to cavity size. Cavity should be no more than 0.25" (6.4 mm) wider than 1" (25.4 mm) thick material and 2" (51 mm) thick material, and 0.4" (10.2 mm) thick material should touch both the outer wythe and the inner wall. For cavities larger than 2" (51 mm), place rigid insulation of sufficient height to extend at least 6" (152 mm) above the top of the Mortar Net® with Insect Barrier against the outside of the inner wythe and of appropriate thickness to reduce the cavity to the appropriate size or add additional layers of mortar net to fill width of cavity.

3. Inspect for and repair holes in flashing immediately prior to installing.

C. Preparation: Clean flashing and weep holes so they are free of mortar droppings and debris immediately prior to installing mortar net. If wicks are used (not recommended), prevent mortar from coating or covering wicks inside the cavity. Washing flashing with water or chemicals prior to installation is not necessary.

D. Installation:

1. For most walls, install one continuous row of trapezoidal shaped mortar net at base of wall and over all wall openings directly on flashing.

2. To prevent mortar bridging between the outer wythe and inner wall, install flashing extending from the bottom of the mortar net to at least 6" above the top of the mortar net.

3. Multiple thicknesses of The mortar net may be installed to match cavity widths and if excessive droppings are expected. Inspection, preparation and installation procedure for multiple thicknesses is the same as for single thickness. When installing multiple thicknesses, align the trapezoidal shaped sections with each other.

4. Lay the first 1 or 2 courses of brick at flashing level, then install mortar net continuously by placing it against the inside of the openings. Install mortar net with fabric facing to the exterior of the wall. No fasteners or adhesives are required, and mortar need not have set.

5. If mortar net coming into contact with wall ties it may be cut or torn to accommodate wall ties, conduit, plumbing or other materials that bridge or intrude into cavity between inner and outer walls.

04 21 13 - BRICK MASONRY

PART 1 - GENERAL

1.1 DESCRIPTION: Furnish all labor, materials, tools, & equipment as required for unit masonry construction, as shown on the Drawings, specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 STANDARDS: The following standards apply to work under this section: ASTM C62 "Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)"; ASTM C67 "Standard Methods of Sampling and Testing Brick and Structural Clay Tile"; ASTM C216 "Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)"; BIA Technical Notes on Brick and Tile Construction; National Concrete Masonry Association "Concrete Masonry Details".

1.4 CONSTRUCTION TOLERANCES - Construct masonry within tolerances established in ACI 531.1-76, 1983, Specification for Concrete Masonry Construction.

1.5 SUBMITTALS:

A. Product Data: Submit manufacturer's product data.

B. Product Samples: Submit sample for each type of masonry showing extremes of variation in color and texture; Manufacturer's board for each type of brick showing extremes of variation in color and texture; Certificate attesting that masonry meet specified qualities and standards.

1.6 MOCK-UP:

A. Construct a sample panel, including but not limited to:
   1. Decorative Masonry Units: Proposed color range, texture and bond.
   2. Mortar.
   3. Structural Backing.
   4. Veneer Anchors.
   5. Flashings and sealing the top of the termination bar.
   6. Weep Vents.
   7. Wall Insulation.
   8. Air Barrier.
   9. Joint Reinforcement.
   10. Vertical Expansion Joint with Sealant and Backer Rod.

B. Locate where directed by the Architect.

C. Mock-up may not remain as part of the work.

D. Do not start work until Architect has accepted sample panel.

E. Use panel as standard of comparison for all masonry work built of the same material.

F. Do not destroy or move panel until work is completed and accepted by the Owner.

1.7 QUALITY ASSURANCE: Perform Work in accordance with Technical Notes on Brick and Tile Construction, by Brick Institute of America (BIA), except as more stringently required in the Contract Document. Before starting masonry work, erect sample masonry walls for each brick type and pattern, as described above. Walls shall face southeast to southwest. Incorporate brick, and all other components of each wall. Do not start masonry work until Architect approves one of the sample walls. Keep and protect approved sample wall on site as standard of masonry work until masonry work is complete, then remove wall.

1.8 STORAGE AND PROTECTION: Store masonry off ground, under cover, to prevent wetting and contamination by weather, mud, dust and materials likely to cause staining.

1.9 PREINSTALLATION CONFERENCE: Schedule and hold preinstallation conference minimum one week prior to beginning of work on scope addressed in this section. Coordinate scheduling of meeting with Architect so that Architect can attend meeting.

PART 2 - PRODUCTS

2.1 FIRED CLAY MASONRY

A. Face brick: As manufactured by Interstate Brick; match existing color, plus one accent color as selected by Architect.

1. Acme Brick Company

2. D'Harris Clay Products

3. Elgin Butler Brick Company

2.2 MORTAR: Make mortar conforming to proportion requirements of ASTM C 270 or C 476. Mortar color to be selected by Architect. For job site pigmented mortar use mineral pigments 5% by weight of cement content. Use potable water. Use liquid water-repellent mortar admixture containing integral water repellent equal to Other admixtures as acceptable to the Architect.

2.3 DETERGENT CLEANING AGENT: Qualities: 1/2 cup trisodium phosphate (such as Calgon) plus 1/2 cup powdered household detergent (such as All), dissolved in 1 gal water.

2.4 MODIFIED ACID CLEANING AGENT: Buffered inorganic acid, such as HC1, with wetting agent. Dissolve in water according to manufacturer's recommendations. Do not use unbuffered, unmodified muriatic acid (HCl). In cleaning light colored brick, increase amount of mixing water 50%, or more as recommended by masonry manufacturer. Approved products are Sure Kleen 600, by Process Solvent Co., Quick Masonry Cleaner, Brick Cleaner 22, by DeltaPlastics, Deox, by National Chemsearch Corp, or Architect-approved substitution.

PART 3 - EXECUTION

3.1 PREPARATION: Examine other construction which supports or connects with masonry work. Where such construction as footings and shelves is not sound or level, where anchorage devices have not been installed, where interferences exist, or where there are other conditions unsuitable for proper installation or performance of the masonry, do not start masonry work until defective earlier construction has been completed or corrected.

3.2 COURSING AND BOND: Course masonry as shown on Drawings. Lay up Exterior Brick in running bond with concave joint. Lay up masonry with approximately 3/8 in. bed joints, uniformly adjusted to produce the specified coursing. Make head joints the same width as bed joints. Lay up masonry in stretcher, header, rowlock, bull header (stretcher rowlock), soldier, or sailor position with only good faces and good ends showing. Cut brick to make headers in veneer and show good end only. Fill voids behind bull headers and sailors with mortars. In brick veneer work over cold formed steel framing, install anchors. Provide shapes as indicated on Drawings, with finished faces at all locations where they will be visible in the Work. Do not cut masonry to make shapes. Finish visible masonry joints using non-rusting tools to form hard impervious surface by hard tooling to a concave profile using jointer slightly larger than joint width. Compress joints and cut flush in unexposed work except at joints below grade. Hard-tool joints below grade to a concave profile.

3.3 INSTALLATION: Lay masonry plumb and true to lines, with level courses. Line up head joints vertically. Use no more than one cut closure in any length of wall. Line up closures vertically. Lay up masonry with completely filled mortar joints. Do not furrow bed joints. Butter end of masonry with sufficient mortar to fill head joint, then shove in place. Rock closures in place with head joints thrown against two adjoining masonry in place. Tap each unit to line and level as it is placed. Do not disturb any unit once in place except to completely remove and set in a fresh bed of mortar. Do not pound corners and jambs to fit stretcher units after they have been set in position. Where an adjustment must be made after mortar has started to harden, remove mortar and replace with fresh mortar. Make all cuts with a power masonry saw. Do not use saw-cut faces in exposed work. Lay up only masonry which have no

chipped, cracked or discolored exposed faces. Lay up with good face showing, lip (if any) always down, frog (if any) always up. Where flat side is shown, provide a brick with flat untorn side matching other masonry faces, without frog, or core holes. Tool joints when thumbprint hard, compressing mortar tightly against both sides of joint. Make head joints match profile of bed joints.

3.4 ANCHORING: Anchor exterior masonry walls facing or abutting concrete members with dovetail or wire anchors inserted in slots built into concrete. Maximum anchor spacing: 24 in. vertically, 36 in. horizontally. Maintain at least 1/2 in. space between masonry and structural concrete beam or wall faces. Keep space free of mortar and other rigid material to permit differential movement. Anchor masonry with dovetail or wire anchors 16 in. on center, inserted into dovetail slots in concrete. Maintain at least 1/2 in. space between masonry and steel or concrete columns. Place 1/2 in. semi-rigid fiberglass board over steel before laying masonry. Do not mortar space between masonry and steel or concrete columns. Where bearing walls or non-bearing partitions abut a concrete or steel column, anchor wall to column with dovetail or wire anchors 16 in. on centers, inserted into dovetail slots in concrete or welded to steel.

3.5 WALL INTERSECTIONS: At intersecting bearing or shear walls which are carried up separately, regularly block vertical joints 3 courses at a time, with 8 in. maximum offsets. Provide joints with rigid steel anchors. Space anchors 48 in. maximum vertically. At non-bearing partitions which abut or intersect other walls or partitions, anchor with cavity wall ties at 24 in. maximum vertical intervals. Alternative method: carry wall reinforcement through intersection, and lap at least 8 in.

3.6 BUILDING IN FLEXIBLE WALL FLASHING: Place wall flashing over a thin bed of mortar, always sloping flashing slightly to exterior. Place mortar over flashing to bed masonry course above it. Turn wall flashing at least 5 in. up behind masonry and anchor top edge by building into backup or by wedging into reglet. Tape, or seal with asphalt cement, all penetrations in wall flashing. Extend wall flashing around outside of structural columns. Extend wall flashing at least 4 in. beyond lintels and sills and turn up ends to form a pan which directs moisture to exterior. Lap wall flashing joints at least 4 in. Extend wall flashing to within 1/4 in. of exterior of mortar joint.

3.7 WEEP HOLES: Install pre-formed plastic grid vent equal to "Quattro Vent" at full height weep holes as shown in the drawings & indicated below. Install cavity mesh to maintain clear air flow & to block rodent entry. Use “mortar boards” in laying masonry units to keep air space clear of mortar droppings. Locate weep holes as follows:

A. 32” on center at base of wall,

B. 16” OC in head joints of masonry directly above wall flashing and other interruptions to downward flow of water such as steel lintels and relief angles, and

C. 64" OC at the top course of masonry taller than 48".

3.8 CAVITY WALL CONSTRUCTION: Maintain full, unobstructed cavity width as shown on Drawings. Measure cavity width exclusive of parging and board insulation thickness. Line all cavity bottoms with through-wall flashing. Weep flashing to outside through holes in face brick head joints. Do not let weep holes become obstructed.

3.9 BUILDING IN OTHER WORK: Build in lintels, door frames, windows, flashing, insulation, reglets, inserts, anchors, blocking, sleeves, boxes, cabinets, piping, conduit, and other items whether provided as part of masonry work, as preparation for other work, or furnished by other trades. Fill steel door frames in masonry walls with mortar. Provide passage for electrical and mechanical lines. Allow and aid placement in walls where lines would be exposed. Cut neat holes for in-wall switches and cabinets. Make provisions for passage of lines, and other chases and openings, during laying up of masonry so that later cutting is not necessary. Fill holes after lines and boxes are in place. Maintain sealant clearances at door, window, and other openings. Provide lintels at all openings in masonry work, as needed to form openings for windows, frames, in-wall equipment, through-wall ducts and piping, and as otherwise needed to support heads of all openings over 8 in. wide.

3.10 CONTROL OF MOVEMENT: Provide control joints constructed by using special control joint units, open end stretcher units, metal sash jamb units, and preformed gaskets, compressible material, building paper and caulking or sealants as indicated on drawings

or as required. Where expansion joints are shown, leave full width of joint free of masonry, mortar and reinforcement, ready for backup material and sealant. At control joints, insert control joint material and leave joint free of masonry and reinforcement. At a minimum, place control joints vertically not more than 24 ft on center, within 5 ft of building corners, and at lines of weakness such as at steel columns, changes in building height, and at each side of openings over 8 ft high. Do not butter masonry units to steel members, except where masonry bears on steel. Maintain 1/2 in. clearance. Fill vertical clearances with 1/2 in. semirigid fiberglass or other sort, incombustible board material. Build non-bearing partitions to a distance 3/8 to 3/4 in. from structural soffit above. When structure above has deflected from building loads placed upon it, wedge partition to structural soffit with metal or slate wedges, and fill top joint with mortar.

3.11 PROTECTION: Cover tops of partially completed walls with strong, non-staining, waterproof membrane, securely held in place, extending at least 24 in. down both sides of wall at start of rain, and at end of each day's work on wall. Clamp protective membrane in place using spring wire clamps. Do not apply dead, live floor, or roof loading for at least 6 hours after building masonry columns or walls. Do not apply concentrated loads for at least 3 days after building masonry columns or walls. Prevent mortar, grout, and cleaning agents from adhering to, staining or deteriorating masonry and other surfaces to be left exposed or painted. Remove mortar, grout, and cleaning agents from masonry and other surfaces daily. Remove them from sensitive surfaces such as aluminum and glass immediately. Protect sills, ledges, and projections from mortar droppings by means of taped paper guards or a layer of sand. Protect door and window frames during masonry construction. Maintain in plumb, square, true position.

3.12 REPAIR OF DEFECTIVE WORK: Remove stained and damaged masonry and replace with new units in fresh mortar bed, of color and tooling matching surrounding work. Repair voids and other defects in mortar joints.

3.13 CLEANING: Start cleaning late in the work, after mortar is thoroughly cured. Dry clean walls before wetting. Remove large particles of mortar with wood paddles and scrapers. Use chisel or wire brush only when wood implements do not work. Soak wall with copious amounts of clean water from hose, flushing off loose mortar and dirt in the process. Scrub walls with detergent cleaning agent, using stiff fiber brush. Rinse off all detergent, dirt, and mortar crumbs using clean water from hose.

3.14 ACID CLEANING: If all mortar is not removed by detergent cleaning, proceed as follows: 1. Soak wall again, until masonry is saturated. Protect work below from damage. 2. Scrub walls with modified acid cleaning agent, using long handled fiber brush. Dilute as specified. Test a small panel of masonry, and rinse, before doing rest of wall. 3. Keep area below soaked with water and flushed free of acid and dissolved mortar. Acid scum, if permitted to dry, can be impossible to remove. Scrub masonry, not mortar joints. Use only wood and fiber tools, never metal ones. Clean in small areas, preferably 10 to 20sq.ft at a time, or smaller if sun or wind cause rapid drying and acceleration of acid reaction. 4. Rinse off all acid, dirt, scum and mortar while wall is still wet. Neutralize areas of masonry work and sensitive surfaces adjoining or below masonry work using spray bottles of weak ammonia. Rinse again.

3.15 ACCEPTANCE OF MASONRY CONSTRUCTION: Completed masonry work which fails to meet requirements must be brought into compliance in an approved manner. The masonry work shall be clean and show a quality of workmanship and finish that conforms to the approved sample when viewed at a distance of 15'. Joints shall be tooled and tight showing no separation between mortar and units.

DIVISION 05 – METALS

05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 GENERAL: Provide cold formed metal framing, metal studs, and accessories as needed for a complete and proper installation. Comply with pertinent recommendations contained in "Specifications for Metal Lathing and Furring" published by the Metal Lath/Steel Framing Association.

1.2 SUBMITTALS: Submit promptly complete product information on this section to the Architect for review. Include joist layout & sizes selected from the manufacturer's span table & actual loading conditions. Sizes indicated are minimums; manufacturer shall verify & modify per required spans. Manufacturers' recommended installation procedures which, when approved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the Work.

1.3 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.4 PERFORMANCE REQUIREMENTS: Calculate structural characteristics of cold-formed metal framing according to AISI's "Load and Resistance Factor Design Specification for Cold-Formed Steel Structural Members" and the Center for Cold-Formed Steel Structures (CCFSS) Technical Bulletin, Vol. 2, No. 1, February 1993 "AISI Specification Provisions for Screw Connections." Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change (range) of 120 deg F.

PART 2 - PRODUCTS

2.1 GENERAL: The size, spacing & gauges indicated are stated as minimums & should be increased as required by the manufacturer's recommendations for the conditions shown.

2.2 MANUFACTURERS: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated in the Work include, but are not limited to, the following:

A. Dale Industries, Inc.
B. Dietrich Industries, Inc.
C. Incor Plant Dale Industries.
D. Unimast, Inc.
E. United States Steel.

2.3 METAL RAFTERS & JOISTS: Manufacturer's standard C-shaped steel joists of web depths indicated, with lipped flanges, & otherwise as required by structural performance. Exceed minimum requirements of Fed Spec QQ-S-698 and Fed Spec QQ-S-775d, class d, sized for the item and use intended; hot-dip galvanized or factory pre-painted. Provide from the following minimum sizes:

A. MEZZANINE JOIST

Joist Member	Description	Size	Gauge	Flange
10"TDW16	TDW-5 TRADEREADY® JOIST-50K	10"	16	2"

2.4 METAL STUDS: Meet or exceed minimum requirements of manufacturer & Fed Spec QQ-S-698 and Fed Spec QQ-S-775d, class d, for the item and use intended. Studs either hot-dip galvanized or factory pre-painted. Use only one manufacturer throughout the Work, unless otherwise shown on the Drawings or specifically approved in advance by the Architect. Provide from the following minimum sizes:

A. INTERIOR DRYWALL PARTITIONS

Product Code	SSMA Code	Gauge	KSI	Width	Length	Punched/Unpunched	Spacing
STN	600S125-18	25	33	6"	9-4	Punched	16"
STE	600S125-33	20	33	6"	9-4	Punched	16"

B. TALL PARTITION

Product Code	SSMA Code	Gauge	KSI	Width	MaxLength	Punched/Unpunched	Spacing
STE	600S125-33	20	33	6"	16-6	Unpunched	16"

C. MEZZANINE SUPPORTING PARTITIONS (16" OC)

Product Code	SSMA Code	Gauge	KSI	Width	MaxLength
CSJ3	600S162-33	20	33	6"	9' 4"
CSW3	600S200-33	20	33	6"	9' 4"

D. EXTERIOR BACKUP WALL

Product Code	SSMA Code	Gauge	KSI	Width	MaxLength	Product Code	SSMA Code
CSJ3	600S162-33	20	33	6"	9' 4"	CSJ3	600S162-33
CSW3	600S200-33	20	33	6"	9' 4"	CSW3	600S200-33

2.5 FURRING - Minimum 1" wide 25 ga (.019) "Z", resiliant channel or hat channel at 24" OC maximum spacing.

2.6 FRAMING ACCESSORIES: Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi. Provide accessories of manufacturer's standard thickness and configuration.

2.7 ACCESSORIES: Provide all accessories including, but not necessarily limited to, tracks, clips, anchors, fastening devices, sound attenuation pencil rods and resilient clips, and other accessories required for a complete and proper installation, and as recommended by the manufacturer of the steel studs used.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct condition detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION: Accurately layout partition and wall lines from the dimensions shown on the Drawings. Install metal studs and accessories in strict accordance with the manufacturer's recommendations as approved by the Architect, anchoring all components firmly into position. Align partition and wall assemblies to a tolerance of one in 200 horizontally and one in 500 vertically.

3.3 BRACING: Provide diagonal bracing & supports to structure as necessary to control movement & deflection.

3.4 COORDINATION: Space members as required for compliance with pertinent regulations, to give proper support for the covering material, and as indicated on the Drawings. Coordinate and provide required backing and other support for items to be mounted on the finished covering. Coordinate requirements for pipes, structure and other items designed to be housed within the partition and wall systems.

3.5 LEVELING: By use of the specified grout, or by other means approved by the Architect, provide continuous solid bearing under floor runner members of steel stud partitions and walls. Level in a manner to provide uniform interface with ceilings and other overhead construction.

05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION: Included under this section will be all labor, materials, tools, & equipment as required for Metal Fabrications & Accessories, as shown on the Drawings, specified herein, and as needed for a complete and proper installation. Work under this section includes:

A. Steel ladders not specified in other sections.
B. Loose bearing and leveling plates.
C. Loose steel lintels & shelf angles.
D. Steel framing and supports not specified in other sections.
E. Metal edgings.
F. Miscellaneous metal trim.
G. Pipe bollards.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section. All work will comply with requirements of the American Welding Society. Meet applicable ASTM or Fed Spec standards for all metal fabrications & components.

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

1.4 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

PART 2 - PRODUCTS

2.1 MATERIALS: In fabricating items which will be expressed to view, limit materials to those which are free from surface blemishes, pitting, rolled trade names, and roughness. Provide any materials, not specifically described but required for a complete & proper installation.

2.2 FERROUS METALS: Provide metal free from pitting, seam marks, roller marks, and other imperfections where exposed to view on finished units. Do not use steel sheet with variations in flatness exceeding those permitted by referenced standards for stretcher-leveled sheet. Steel Plates, Shapes, and Bars complying with ASTM A 36/A 36M. Cold-formed steel tubing complying with ASTM A 500.

A. All exterior exposed ferrous metals to be galvanized and painted.

2.3 FASTENERS: For exterior use and where built into exterior walls, provide zinc-coated fasteners. Provide fasteners of type, grade, and class required for the particular use.

2.4 GALVANIZING: Hot-dip galvanize items as indicated to comply with ASTM A 123, for galvanizing steel and iron products & ASTM A 153/A 153M, for galvanizing steel and iron hardware.

2.5 SHOP PRIMING: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements of SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.6 FABRICATIONS: Except as otherwise shown on the Drawings or the approved Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability.

2.7 PIPE BOLLARDS: Fabricate pipe bollards from Schedule 80 steel pipe. Cap bollards with 1/4-inch-minimum steel plate. Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.

2.8 LOOSE STEEL LINTELS: Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated. Members supporting masonry, such as lintels, shall have a maximum deflection of L/600.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION: Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 WELDING: Perform shop and/or field welding required in connection with the work of this Section in strict accordance with pertinent recommendations of the American Welding Society.

3.4 FABRICATION: Fabricate with accurate angles and surfaces which are true to the required lines and levels, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners wherever possible. Prior to shop painting or priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the item. On surfaces inaccessible after assembly or erection, apply two coats of the primer.

3.5 INSTALLATION: Set work accurately into position, plumb, level, true, and free from rack. Anchor firmly into position. Where field welding is required, comply with AWS recommended procedures of manual-shielded metal-arc welding for appearance and quality of weld and for methods to be used in correcting welding work. Grind exposed welds smooth, and touch-up shop prime coats. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.

3.6 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any. Anchor supports for operable partitions securely to and rigidly brace from building structure. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified above for setting and grouting bearing and leveling plates.

3.7 CLEANING: Immediately after installation, clean field welds, bolted connections, and abraded areas of shop priming. Paint the exposed areas with same material used for shop priming.

05 51 33 - METAL LADDERS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Prefabricated mezzanine access ladders.

B. Prefabricated roof access ladders.

1.2 RELATED SECTIONS

A. Section 06 10 00 - ROUGH CARPENTRY: Blocking in metal wall studs and partitions for anchorage of access ladders

1.3 REFERENCES

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 1992.

B. OSHA 29 CFR Standard 1910.27 - Fixed ladders; Occupational Safety and Health Standards; current edition

1.4 SUBMITTALS

A. Submit under provisions of Section 01 33 23.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

C. Shop Drawings: Detailed drawings showing complete dimensions, all materials, mounting attachments, and fabrication details.

1.5 WARRANTY: Manufacturer’s 5 year limited warranty.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the engineering and manufacturing of metal ladders.

PART 2 - PRODUCTS

2.1 PREFABRICATED MEZZANINE ACCESS LADDERS

A. BASIS OF DESIGN: ALACO Ladder Co., Model 485 ladder for mezzanine access. They are extendible, then can be folded away when not in use. These ladders are available standard with extended handrail configurations, with non-marking, solid rubber feet for secure floor contact when extended. This model can be ordered without handrails, or with flush handrails.

B. CONSTRUCTION & MATERIALS: Aluminum ladders and their components to be fabricated from 6061-T6 aluminum alloy for added safety, strength and long-lasting durability, with no painting required; 3" (76mm) wide steps mounted on 12" (305mm) centers; mounting bracket-slide assemblies for flat storage against the wall. Non-marking solid rubber feet extend 3/4" (19.1mm) from the rail ends for secure installation at a 80 degree angle. Handrails 1-1/4" (32mm) round serrated aluminum tubing with cast aluminum fittings.

C. SIZES: Height- up to 14' (4.2 m); Width- 24" (610mm)

D. FINISHES & COATINGS: Mill finish standard on aluminum ladders.

E. APPLICABLE STANDARDS: American National Standards Institute (ANSI) - ANSI A14.3 American National Standard for Ladders - Fixed - Safety Requirements

F. APPROVALS: U.S. Occupational Safety and Health Administration (OSHA); ALACO aluminum ladders are certified to meet OSHA/ANSI A14.3 standards for fixed wall ladders.

G. WARRANTY: limited warranty of 5 years.

2.2 PREFABRICATED ROOF ACCESS LADDERS

A. BASIS OF DESIGN: ALACO Ladder Co. Model 480 ladders for roof hatch access, extendible with flush handrails; to be folded away when not in use. Provide standard with non-marking, solid rubber feet for secure floor contact when extended.

B. CONSTRUCTION & MATERIALS: Aluminum ladders and their components to be fabricated from 6061-T6 aluminum alloy for added safety, strength and long-lasting durability, with no painting required; 3" (76 mm) wide flat steps with nonslip ridges, mounted on 12" (305 mm) centers. Provide mounting bracket-slide assemblies for flat storage against the wall; non-marking solid rubber feet extend 3/4" (19.1mm) from the rail ends for secure installation at an 80 degree angle; flush handrails of 1-1/4" (32 mm) round serrated aluminum tubing with cast aluminum fittings.

C. SIZES: Height- Up to 14' (4.2 m); Width- 20" (508 mm)

D. FINISHES & COATINGS: Mill finish is standard on aluminum ladders.

E. APPLICABLE STANDARDS: American National Standards Institute (ANSI) - ANSI A14.3 American National Standard for Ladders - Fixed - Safety Requirements

F. APPROVALS: U.S. Occupational Safety and Health Administration (OSHA); ALACO aluminum ladders are certified to meet OSHA/ANSI A14.3 standards for fixed wall ladders.

G. WARRANTY: limited warranty of 5 years.

PART 3 - EXECUTION

3.1 EXAMINATION: Do not begin installation until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 INSTALLATION: Install in accordance with manufacturer's instructions and approved shop drawings, and in compliance with ANSI A14.3 and OSHA 1910.27.

3.3 PROTECTION: Protect installed products until completion of project. Touch-up, repair or replace damaged products before Substantial Completion.

DIVISION 06 – WOODS, PLASTIC AND COMPOSITES

06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS: Rough carpentry includes carpentry work not specified as part of other sections and which is generally not exposed, except as otherwise indicated. Drawings, General and Supplementary Conditions apply to work of this section.

1.2 PRODUCT HANDLING: Protect against exposure to weather and contact with damp or wet surfaces, providing air good circulation.

1.3 COORDINATION: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.

PART 2 - PRODUCTS

2.1 LUMBER GENERAL: Manufacture lumber to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review. Inspection agencies and the abbreviations used include: NLGA - National Lumber Grades Authority, SPIB - Southern Pine Inspection Bureau, WCLIB - West Coast Lumber Inspection Bureau, WWPA - Western Wood Products Association. Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill. Nominal sizes are indicated, except as shown by detail dimensions. Provide dressed lumber, S4S, unless otherwise indicated. Provide seasoned lumber with 19% maximum moisture content at time of dressing and shipment for sizes 2" or less in nominal thickness.

2.2 DIMENSION LUMBER: For light framing (2" to 4" thick, 2" to 4" wide) provide Construction grade; any species graded under WWPA or WCLIB rules, Southern Pine graded under SPIB rules, or Spruce-Pine-Fir graded under NLGA rules. For structural framing (2" to 4" thick, 5" and wider), provide No. 2 grade; Douglas Fir graded under WCLIB or WWPA rules, Hem-Fir graded under WWPA rules, or Southern Pine graded under SPIB rules.

2.3 BOARDS: Where boards will be concealed by other work, provide lumber of 19% maximum moisture content (S-DRY) and of Southern Pine No. 2 Boards per SPIB rules, or any species graded Contraction Boards per WCLIB or WWPA rules. Provide sizes indicated.

2.4 MISCELLANEOUS LUMBER: Provide wood for support or attachment of other work of size shown. Moisture content 19% maximum for lumber items not specified to receive wood preservative treatment. Use Standard Grade light framing lumber of any species or size required.

2.5 CONSTRUCTION PANELS: Comply with PS 1 "U.S. Product Standard for Construction and Industrial Plywood" for plywood panels or American Plywood Association (APA) "Performance Standard and Policies for Structural-Use Panels", Form No. E445. To be fire retardant treated and shall conform to DOC PS 1.

A. Subflooring & Roof Sheathing: APA rated exposure 1 sheathing. Span rating as required to suit joist spacing indicated. Thickness 5/8" minimum, or as indicated.

B. Plywood Backing Panels: For mounting electrical or telephone equipment, provide fire-retardant treated plywood APA C-D PLUGGED INT with exterior glue, not less than 1/2".

C. Plywood Underlayment: Provide plywood panels in thickness indicated and complying with APA UNDERLAYMENT INT with exterior glue & fully sanded face. Thickness 5/8" minimum, or as indicated.

D. Exterior Wall Sheathing: APA rated exposure 1 sheathing. Span ratings as required for stud spacing. Thickness ½" minimum, or as indicated.

2.6 MISCELLANEOUS MATERIALS:

A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

B. Where rough carpentry work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with a hot-dip zinc coating (ASTM A 153).

C. Building Paper: ASTM D 226, Type I; asphalt saturated felt, non-perforated, 15-lb. type.

2.7 WOOD TREATMENT: Unless indicated otherwise, treated lumber to be pressure wolmanized #1 YP, conforming to AWPA standards, with retention of .25 for weather contact & .40 for ground contact. Treat indicated items and the following: Wood cants, nailers, curbs, blocking, stripping, sheathing and similar members in connection with roofing, flashing, vapor barriers and waterproofing, wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete. Treated plywood to be pressure wolmanized conforming to AWPA standards.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL: Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement. Set carpentry work to required levels and lines, with members plumb and true and cut and fitted. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

3.2 WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS: Provide wherever shown and where required for screeding or attachment of other work. Coordinate location with other work involved. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise show.

3.3 WOOD FRAMING, GENERAL: Provide framing members of sizes and on spacing shown, and frame openings as shown, comply with recommendations of "Manual for House Framing", "Recommended Nailing Schedule" and "National Design Specifications for Wood Construction" of National Forest Products Association (N.F.P.A.). Do not splice structural members between supports. Firestop concealed spaces where firestops are not automatically provided by the framing system used.

3.4 TREATED WOOD: Construct all exterior exposed framing & sole plates on slab of treated wood.

3.5 INSTALLATION OF CONSTRUCTION PANELS: Comply with applicable recommendations contained in Form No. 30D. "APA Design/Construction Guide - Residential & Commercial," for types of construction panels and applications indicated. Fasten panels as indicated below:

A. Subflooring: Glue-nail to framing.
B. Underlayment: Nail to subflooring. Fill and sand edge joints of underlayment receiving resilient flooring.
C. Plywood Backing Panels: Nail to supports.

06 20 23 - FINISH CARPENTRY

PART 1 - GENERAL

1.1 SCOPE: Furnish all finish carpentry shown on drawings and specified herein. Architectural woodwork includes all exterior and interior woodwork exposed to view in finished building.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 SUBMITTALS: Submit shop drawings on all items of architectural woodwork. Submit manufacturer's descriptive literature of specialty items not manufactured by the architectural woodworker, as requested by the architect. Submit samples of each wood spec which is to receive transparent finish at job site, as requested by the architect. Submit finished samples of each finish to be applied at factory.

1.4 FIELD DIMENSIONS: The woodwork manufacturer is responsible for details and dimensions not controlled by job conditions and shall show on his shop drawings all required field measurements beyond his control. The general contractor and the woodwork manufacturer shall cooperate to establish and maintain these field dimensions.

1.5 PRODUCT HANDLING: The woodwork manufacturer and the contractor shall be jointly responsible to make certain that woodwork is not delivered until the building and storage areas are sufficiently dry so that the woodwork will not be damaged by excessive changes in moisture content.

1.6 QUALITY ASSURANCE: The latest edition "Quality Standards" of the Architectural Woodwork Institute shall apply and by reference are hereby made a part of this specification. Any item not given a specific quality shall be Custom grade as defined in the latest edition of the AWI "Quality Standards". The approved woodwork manufacturer must have a reputation for doing satisfactory work on time and shall have successfully completed comparable work.

PART 2 - PRODUCTS:

2.1 STANDING AND RUNNING TRIM: Exterior - AWI custom grade Red Cedar. Interior for Opaque Finish - AWI custom grade white pine.

2.2 CLOSET & STORAGE SHELVING: Unless noted otherwise, AWI standard grade painted plywood.

2.3 COUNTER & LAVATORY TOPS: Unless noted otherwise, high pressure plastic laminate on 3/4" exterior grade plywood with 4" splash to wall.

2.4 PLASTIC LAMINATE: 1/16" thick, color selected by Owner, by Formica or Wilsonart.

2.5 OTHER MATERIALS: Furnish and install any supplementary materials, weather or not specifically indicated, required for a complete and proper installation, as selected by the Contractor subject to the acceptance of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 CONSTRUCTION: Install the work of this Section in strict accordance with the original design, requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position. Attach finish carpentry with fine finishing nails, countersink & fill holes; blind nail where possible.

3.3 CABINETS: Shop assemble all cabinets. Plastic laminate to be placed in one piece up to 12'. Provide wood blocking in new walls to support all cabinets & mount securely. Provide 4" toespace on all cabinets.

3.4 PROTECTION: Protect work during construction; damaged, stained or split material will be replaced. Protect cabinets during storage, installation & until final acceptance; replace any damaged material.

06 40 23 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY: This Section includes the following:
- A. Interior standing and running trim.
- B. Wood shelving.
- C. Plastic-laminate countertops not included in other sections.

1.3 DEFINITIONS: Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction prior to woodwork installation. Rough carriages for stairs are a part of interior architectural woodwork. Platform framing, headers, partition framing, and other rough framing associated with stair-work are specified in Division 6 Section "Rough Carpentry."

1.4 SUBMITTALS: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections. Product data for each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.5 QUALITY ASSURANCE: Firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units without delaying the Work. Arrange for interior architectural woodwork installation by a firm that can demonstrate successful experience in installing architectural woodwork items similar in type and quality to those required for this Project. Except as otherwise indicated, comply with the AWI Quality Standard: "Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grades of interior architectural woodwork, construction, finishes, and other requirements.

1.6 DELIVERY, STORAGE, AND HANDLING: Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.7 PROJECT CONDITIONS: Do not deliver or install woodwork until building is enclosed, wet-work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period. Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.

1.8 COORDINATION: Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and, where the following products are part of interior woodwork, with requirements of the referenced product standards that apply. Comply with requirements of NPA 9.

2.2 HIGH-PRESSURE DECORATIVE LAMINATE: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard. Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following: Formica Corporation, Pioneer Plastics Corp., Ralph Wilson Plastics Co. Chemical-Resistant, High-Pressure Decorative Laminate: NEMA LD 3, Grade PF-42.

A. LAMINATE MANUFACTURER COORDINATION: Laminate manufacturer to be same for following systems:

1. 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK
2. 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS
3. 06 41 17 - PLASTIC-LAMINATE-CLAD ADJUSTABLE SHELVING
4. 08 14 23 - PLASTIC-LAMINATE-FACED WOOD DOORS
5. 10 12 00 - STOREFRONT DISPLAY CASES

2.3 SPECIALTY LAMINATE

A. Marker Board Laminate/ Basis of Design: Wilsonart 1573-09 or 1572-09

2.4 INSTALLATION MATERIALS: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

2.5 FABRICATION, GENERAL: Provide interior woodwork complying with the referenced quality standard and of Custom Grade. Comply with requirements of referenced quality standard for wood moisture content in relation to relative humidity conditions existing during time of fabrication and in installation areas. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting. Install glass to comply with applicable requirements of Division 8 Section "Glazing" and of FGMA "Glazing Manual." For glass in wood frames, secure glass with removable stops.

2.6 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH: Comply with AWI Section 300. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work. Assemble casings in plant except where limitations of access to place of installation require field assembly. Wood Species: Red oak, rift sawn (In existing buildings, match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated).

2.7 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH: Comply with AWI Section 300. Any closed-grain hardwood listed in referenced woodworking standard.

2.8 COUNTERTOPS

A. Laminate: High-pressure decorative laminate complying with Grade PF-42, 0.042-inch nominal thickness. Provide materials and products from manufacturer's full range of colors and finishes in solid colors. Substrate to be plywood; provide post-formed at damp locations.

B. Stainless Steel: Sheet material to be 18-8, Type 302, polished to 180 grit No. 4 finish; joints and seams heli-arc welded, free of pits and flaws, ground smooth and polished to No. 4 finish. The “grain” direction of horizontal stainless steel surfaces to be longitudinal, including the splashback. The polishing procedure at right-angle corners of fixtures shall provide a mitered appearance.

2.9 INTERIOR ORNAMENTAL WORK FOR TRANSPARENT FINISH: Comply with AWI Section 700. Red oak, rift sawn (In existing buildings, match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building, unless otherwise indicated).

2.10 ACCESSORIES:

A. Adjustable Shelf Standards: B04071.
B. Shelf Rests: B04013.
C. Grommets for cable passage through countertops: 1 inch OD brown, molded-plastic grommets with 3/4-inch hole and brown plastic cap with slot for wire passage.

PART 3 - EXECUTION

3.1 PREPARATION: Condition woodwork to average prevailing humidity conditions in installation areas before installing. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 1/8 inch in 96 inches. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated. Complete the finishing work specified in this Section to the extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in the shop.

3.3 STANDING AND RUNNING TRIM INSTALLATION: Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, if required. Match color and grain pattern across joints. Install trim after gypsum board joint finishing operations are completed. Drill pilot holes in hardwood before fastening to prevent splitting. Fasten to prevent movement or warping. Countersink fastener heads on exposed carpentry work and fill holes. Fit exterior joints to exclude water. Apply flat grain lumber with bark side exposed to weather.

3.4 COUNTERS: Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line. Anchor tops securely to support systems as indicated. Caulk space between backsplash and wall with specified sealant.

3.5 ADJUSTING AND CLEANING: Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance. Clean, lubricate, and adjust hardware. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.6 PROTECTION: Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 DESCRIPTION: Plastic laminate surfaced casework required for this work is scheduled on the drawings. Cabinet bodies at sink base units & all counter tops to be exterior grade plywood core.

1.2 QUALITY ASSURANCE: It is the intent of this specification to establish minimum standards for materials, construction, workmanship and finished product of the work to be performed under this section.

1.3 SUBMITTALS:

A. Shop Drawings: Submit shop drawings for all work furnished under this section. Drawings shall show size, arrangement, type of material, construction and relationship to adjacent work.

B. Product Data: Submit product data on plastic laminate and hardware.

C. Product Samples: Submit samples of plastic laminate to Architect for selection.

D. Close-out Documents: Upon completion of installation, and as a condition of its acceptance, submit copies of warranties, operating instructions and maintenance instructions, if applicable.

1.4 PRODUCT INSTALLATION: Furnish, deliver and install all casework, countertops, fillers and accessory items indicated on the drawings or equipment schedule as part of this section.

1.5 WORK BY OTHER TRADES: Furnishing, installation and connection of all piping, wiring, conduit, junction boxes and related items required to provide services from building rough-ins to service fixtures within casework and equipment. Sinks and service fixtures other than those scheduled as part of Science Casework unless specifically indicated as work to be supplied under this section. Furnishing, installation and connection of traps, drainlines and vents, including required supports, straps and hangers. Furnishing and installation of wood blocking, framing or reinforcement within building walls to adequately support casework. Furnishing and installation of rubber, vinyl or other special base.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Particle board shall be a minimum 45 # density, balanced construction with moisture content not to exceed eight (8) percent and shall meet or exceed Commercial Standard CS236-66 Type 1, Density B, Class 2.

B. Plastic Laminate:

1. Plastic laminate 1/16" thick, color selected by Architect & approved by Owner, by Formica, Wilsonart, or another manufacturer approved by the Architect.

2. Exposed exteriors of cabinets and casework shall be vertical surface type high pressure plastic laminate .032” thick meeting or exceeding NEMA Standards LD#-1985 CL20. Color shall be selected by Owner.

3. Interior face of cabinets and casework shall be .020” thick high pressure plastic laminate cabinet liner meeting or exceeding NEMA Standards LD3-1985 CL20. Color shall be selected by Owner. Concealed face(s) of cabinet and casework end, back and concealed face(s) of tops and bottoms for base cabinets and tall cabinets shall be faced with backer sheet.

4. High pressure laminate for plastic laminate sufficed countertops shall be general purpose grade .050” meeting or exceeding NEMA Standards LD3-1985 GP50. Selection from manufacturer’s standard domestic patterns. Underside faced with backer sheet.

5. Laminates for acid-resistant plastic laminate surfaced countertops shall be CHEMSURF as manufactured by Ralph Wilson Plastics Company, Temple, Texas. Selection from manufacturer's standard patterns. Underside faced with backer sheet.

6. LAMINATE MANUFACTURER COORDINATION: Laminate manufacturer to be same for following systems:

   a. 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK
   b. 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS
   c. 06 41 17 - PLASTIC-LAMINATE-CLAD ADJUSTABLE SHELVING
   d. 08 14 23 - PLASTIC-LAMINATE-FACED WOOD DOORS
   e. 10 12 00 - STOREFRONT DISPLAY CASES

C. Casework Edging: Edges of all casework, cabinet doors, drawer fronts & shelves shall be banded with shop-applied, underlapped, high pressure 3 mil plastic laminate edgeband, the same color as exterior face.

2.2 HARDWARE:

A. Pulls shall be solid brass with a satin chrome finish (U.S.26D) 4" x 5/16". Hinges shall be five knuckle 2 3/4" overlay type hospital tip, >095" thick steel with U.S.26D dull chrome finish. Doors less than 42" in height have two hinges, doors 42" to 72' in height have three hinges and doors over 72" in height have four hinges.

B. Drawers: Drawers are to be a four-sided box constructed of 1/2" thick premium grade 9-ply Baltic birch plywood. All exposed edge of the plywood to be edgebanded. Drawer bottoms are to be 1/4" thick birch plywood. Drawer end shall be fastened to the drawer front and back with chuck and bore joinery. All drawers to receive a 7-level polyest super finish. Drawer slides for standard drawers to be heavy duty 100# test white epoxy coated with a ball bearing slide system, KV-1284 or equal. Drawer slides for file drawers to be heavy duty 100# test, precision full extension type with an anochrome finish, KV-8400 or equal.

C. All hinged doors shall be equipped with magnetic type door catches having a minimum ten (10) pound pull, attached with screws and slotted for adjustment. Doors for tall cabinets shall have two catches. Catches to have a metal housing.

D. Adjustable shelf supports shall be Knape and Vogt 348 Series metal shelf supports designed for installation in holes pre-frilled on 1 1/4" centers in cabinet ends and vertical partitions. Shelf supports have resilient black plastic coating to prevent shelf forward motion.

E. Lock for casework drawers and hinged doors shall be provided at all locations indicated on drawings or as required by function. Lock shall be five (5) tumbler dead bolt. Each lock shall be furnished with two (2) keys. Locks indicated for sliding glass doors shall be ratchet type sliding showcase locks not subject to masterkey. Include locks at all Teacher's Cabinets and Full Height Storage Cabinets. Key all cabinet locks in a room the same & each room differently.

F. Coat rods shall be 1" diameter chrome plated steel with molded tan color plastic flanges

G. Elbow catches shall be used on inactive door when lock is used on pair of doors.

H. Coat hooks to be heavy-duty, cast, double ended.

2.3 CABINET AND CASEWORK CONSTRUCTION: All casework shall be flush overlap type construction. All parts shall be machined for accurate fit and assembled in case clamps under pressure using wood dowels and glue to ensure secure joints and cabinet squareness without exposed fasteners. All dowels shall be minimum eight (8) millimeter diameter, laterally fluted with chamfered ends. Modified or custom units shall be fabricated using similar joinery. All base cabinets and tall cabinets shall have integral bases with unfinished toeboard for application of rubber or vinyl base by "Other Trades". Horizontal rails shall be provided at the top of base cabinets (front and rear), above double doors or drawer/cupboard units and above all drawers and single doors having locks. All horizontal rails shall be 17/16" x 5 1/2". All cabinet ends, tops, bottoms, vertical partitions, fixed intermediates, cabinet doors and drawer fronts shall be 3/4" particle board core (except wet locations), surfaced and edged with the appropriate laminate. Cabinet bodies at sink base units & all counter tops to be exterior grade plywood core. All adjustable shelves in cabinets shall be 3/4" plywood with any exposed edges banded. Shelves shall be surfaced on both faces and edged with the appropriate laminate indicated previously under "Materials". All cabinet and casework backs shall be 3/8"kv particle board core. Interior faces not

normally exposed to view shall be surface with frosty white color melamine roll laminated to core in line with a hydraulic hot press with concealed back face surfaced with backer. The grade designation is general purpose (GP20) surface. Applied finished back shall be 3/4" particle board core surfaces with the appropriate laminate indicated previously under "Materials". Cabinet doors and drawer fronts shall be 3/4" particle board with .032" vertical surface type plastic laminates on exterior surfaces and .020" frosty white color cabinet liner on interior surfaces with doors and drawer fronts edge banded as indicated previously under "Materials".

2.4 CASEWORK COUNTERTOPS: Countertops shall be high pressure plastic laminate surfaced; at damp locations provide one piece post-formed, on exterior grade plywood core. Cores shall be 1" thick with 3/4" cores at backsplashes and end splashes. Face and edges shall be surfaced with 1/16" General Purpose grade high pressure laminate. Unexposed surfaces shall be faced with backer. Standard backsplashes shall be 4" high unless otherwise shown or indicated. Return walls and tall cabinets. Return splashes shall be mounted to the edge of countertops with screws and shall be sealed before installed.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Prior to installation, verify that equipment may be installed in accordance with manufacturer's recommendations. In the event of a discrepancy, do not proceed with installation until such discrepancy has been resolved.

3.2 INSTALLATION: Installation shall be performed by manufacturer's authorized representatives unless otherwise designated by contract documents. Installation work shall conform to manufacturer's standard procedures. Casework and equipment is to be set accurately in place, scribed and permanently secured to the building walls and/or floors. Installation of edgebanding on Item 2.1.4 will be put on after the plastic laminate surfaced countertops. The edgebanding will be put on last.

3.3 ADJUSTMENT AND CLEANING: Verify that all equipment is properly installed and operational. All debris resulting from this installation shall be removed and casework interiors and exteriors cleaned at completion.

3.4 PROTECTION: Protect work during storage, installation & until final acceptance, replacing any damaged material.

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

07 21 16 - BLANKET INSULATION

PART 1 - GENERAL

1.1 GENERAL DESCRIPTION: Provide building insulation where shown on the Drawings, as specified herein, and as needed for a complete and proper installation. Documents affecting work of this Section include, but are not limited to General & Supplementary Conditions.

1.2 QUALITY ASSURANCE: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. Upon completion of this portion of the Work, complete and post a certificate of insulation compliance in accordance with pertinent requirements of governmental agencies having jurisdiction.

1.3 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

PART 2 - PRODUCTS

2.1 MATERIALS: Provide the following building insulation where shown on the Drawings or otherwise needed to achieve an insulated envelope around conditioned spaces, & as required under pertinent regulations of governmental agencies having jurisdiction. Insulation material to have a flame spread of 10 & smoke developed of 10, meeting requirements of SBCCI 719.

2.2 EXTERIOR STUD WALL: Cavity thick unfaced glass fiber batts with suspension device.

2.3 INTERIOR STUD WALL: Cavity thick unfaced glass fiber sound isolating batt with suspension device.

2.4 ACOUSTICAL CEILING INSULATION: 4” thick unfaced glass fiber sound isolating batt. Except as noted otherwise, place 24” on either side above walls seperating classrooms, hallways & offices.

2.5 OTHER MATERIALS: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected. Remove, or protect against, projections in construction framing which may damage or prevent proper insulation.

3.2 INSTALLATION: Install the work of this Section in strict accordance with the original design, requirements of governmental agencies having jurisdiction, and the manufacturer's recommended installation procedures as approved by the Architect, anchoring all components firmly into position. Insulation will be installed at building envelope enclosing conditioned space (walls, ceiling) & as indicated on the drawings. Do not place attic insulation above, or within 3" of any recessed light fixture. Install exposed building insulation tight with reverse stapled seams, to give a consistent finished appearance.

3.3 EXPOSED INSULATION: If wallboard is not present on interior of exterior wall: Insulation Straps at 4’-0” O.C., Chicken Wire or Fast-R Insulation Hangers.

07 21 29 - SPRAYED INSULATION

PART 1 - GENERAL

1.1 SUBMITTALS: Provide data on materials, describing insulation properties, surface burning characteristics. Indicate special procedures, perimeter conditions requiring special treatment. Certify that products meet or exceed specified requirements.

1.2 QUALIFICATIONS: Manufacturer & Applicator to be companies specializing in manufacturing the products specified in this section with minimum 3 years experience.

1.3 REGULATORY REQUIREMENTS: Conform to applicable code for flame and smoke ratings.

1.4 ENVIRONMENTAL REQUIREMENTS: Products containing urea-formaldehyde will not be permitted. Products and equipment requiring or using CFCs or HCFCs during the manufacturing process will not be permitted.

1.5 DELIVERY, STORAGE, AND HANDLING: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material. Store materials in an area protected from freezing and overheating damage and in accordance with manufacturer's instructions. Protect materials during handling and application to prevent damage and contamination.

PART 2 - PRODUCTS

2.1 MANUFACTURER: Icynene, Inc., 5805 White Road, Suite 110, Mississauga, Ontario L4Z 2J1 Canada.

2.2 OPEN CELL FOAM: Polyicynene Spray Insulation, hydrophobic, low-density, open-cell modified polyicynene; conforming to the following:

A. Thickness: 3-1/2"
B. Thermal Resistance (R-Value/inch): ASTM C518; 3.6 hr/sq ft/degree F/BTU. In.
C. Air Permeance (for 5.25 inches of material): ASTM E283; 0.0049 l/m^2/second.
D. Water Vapor Transmission (for 5 inches of material): ASTM E96; 10 perms.
E. Sound Transmission Class (STC): ASTM E90; STC 37 in wood stud wall.
F. Noise Reduction Coefficient (NRC): ASTM E90; NRC-0.7 in wood stud wall.
G. Corrosion: No significant corrosion when in contact with steel under 85 percent relative humidity.
H. Bacterial or Fungal Growth: No growth; no material deterioration.
I. Flame Spread and Smoke Developed Rating: ASTM E84; <20/<400.
J. Fuel Contribution: ASTM E84; 0.
K. Oxygen Index: ASTM D2863; average value 23.1 percent.

PART 3 - EXECUTION

3.1 EXAMINATION: Verify existing conditions before starting work. Verify that substrate is free of any foreign material that will impede application. Verify that other work on and within spaces to be insulated is complete prior to application. Notify Architect of conditions that would adversely affect the application. Beginning of installation means applicator accepts existing conditions.

3.2 PREPARATION: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive insulation. Mask and protect adjacent surfaces from overspray or damage. Remove foreign materials, dirt, grease, oil, paint, laitance, efflorescence, and other substances that will affect application.

3.3 APPLICATION: Apply insulation in accordance with manufacturer's written application instructions. Apply insulation to a reasonably uniform monolithic density without voids. Apply insulation to fill all voids around accessible service and equipment penetrations.

3.4 PROTECTION OF FINISHED WORK: Do not permit subsequent work to disturb applied insulation.

07 26 18 - UNDER-SLAB VAPOR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. Products supplied under this section:

1. Vapor barrier and installation accessories for installation under concrete slabs.

B. Related sections:

1. Section 03 30 00 Cast-in-Place Concrete

2. Section 07 26 18 Vapor Retarders

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E1745- 11Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

2. ASTM E1643- 11Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

B. Technical Reference - American Concrete Institute (ACI):

1. ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

1.3 SUBMITTALS

A. Quality control/assurance:

1. Summary of test results per paragraph 9.3 of ASTM E1745.

2. Manufacturer’s samples and literature.

3. Manufacturer’s installation instructions for placement, seaming, penetration repair, and perimeter seal per ASTM E1643.

4. All mandatory ASTM E1745 testing must be performed on a single production roll per ASTM E1745 Section 8.1.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor barrier shall have all of the following qualities:

1. Maintain permeance of less than 0.01 Perms [grains/(ft2 · hr · inHg)] as tested in accordance with mandatory conditioning tests per ASTM E1745 Section 7.1 (7.1.1-7.1.5).

2. Other performance criteria:

a. Strength: ASTM E1745 Class A.

b. Thickness: 15 mils minimum

c. Provide documentation that all testing was performed on a single production roll per ASTM E1745 Section 8.1

B. Vapor barrier products:

1. Basis of Design: Stego Wrap Vapor Barrier (15-mil) by Stego Industries LLC., (877) 464-7834 www.stegoindustries.com.

2. Approved Alternate: Vaporguard by Reef Industries, 713-507-4250. www.reefindustries.com.

3. Approved Alternate: Sundance 15 mil Vapor Barrier by Sundance Inc., (855) 300-7156 www.sundancepolymertech.com.

4. Approved Alternate: Perminator 15 mil Underslab Vapor Barrier by W.R. Meadows, (800) 342-5976 www.wrmeadows.com.

5. Approved Alternate: Xtreme Vapor Barrier 15 mil Vapor Barrier by Tex-Trude, (281) 452-5961, www.tex-trude.com.

2.2 ACCESSORIES

A. Seams :

1. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

B. Penetrations of Vapor barrier:

1. Stego Mastic by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

2. Stego Tape by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

C. Perimeter/edge seal:

1. Stego Crete Claw by Stego Industries LLC, (887) 464-7834 www.stegoindustries.com.

2. Stego Term Bar by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

3. StegoTack Tape (double sided) by Stego Industries LLC, (877) 464-7834 www.stegoindustries.com.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by Architect or Geotechnical Engineer.

1. Level and compact base material.

3.2 INSTALLATION

A. Install vapor barrier in accordance ASTM E1643.

1. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement and face laps away from the expected direction of the placement whenever possible.

2. Extend vapor barrier over footings and grade beams to a distance acceptable to the structural engineer or stop at impediments such as dowels and waterstops.

3. Seal vapor barrier to slab perimeter/edge using Stego Crete Claw and remove dirt, debris, and mud from Crete Claw prior to concrete placement.

4. Overlap joints 6 inches and seal with manufacturer's tape.

5. Apply tape/Crete Claw to a clean and dry vapor barrier.

6. Seal all penetrations (including pipes) per manufacturer's instructions.

7. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.

8. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all sides with tape.

07 40 00 – SIDDING AND SOFFIT PANELS

PART 1 - GENERAL

1.1 SECTION INCLUDES
- A. Preformed, prefinished metal panel and flashings.
- B. Miscellaneous trim, flashing, closures, drip flashing, and accessories.
- C. Fastening devices.
- D. Waterproofing membrane.

1.2 RELATED SECTIONS
- A. Light Gauge Metal Framing.
- B. Miscellaneous metal fabrication.
- C. Rough Carpentry.
- D. Ice & Water Shield

1.3 REFERENCES

A. American Iron & Steel Institute (AISI) Specification for the Design of Coldformed Steel Structural Members.

B. ASTM A-653 & ASTM A924 Steel Sheet, Zinc-Coated (Galvanized)

C. SMACNA - Architectural Sheet Metal Manual.

1.4 ASSEMBLY DESCRIPTION: The assembly includes preformed sheet metal panels, related accessories, flashing and attaching devices.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions.

B. Detail Drawings: Submit detailed drawings showing layout of panels, anchoring details, joint details, trim, flashing, and accessories. Show details of weatherproofing, terminations, and penetrations of metal work.

C. Product Samples: Submit a sample of each type of panel, complete with factory finish.

1.6 QUALITY ASSURANCE

A. Manufacturer: Company specializing in Architectural Sheet Metal Products with ten (10) years minimum experience.

B. No product substitutions shall be permitted without meeting specifications.

C. Substitutions shall be submitted 10 Days prior to Bid Date and acceptance put forth in an addendum.

D. No substitutions shall be made after the Bid Date.

1.7 DELIVERY, STORAGE AND HANDLING

A. Upon receipt of panels and other materials, installer shall examine the shipment for damage and completeness.

B. Panels should be stored in a clean, dry place. One end should be elevated to allow moisture to run off.

C. Panels with strippable film must not be stored in the open, exposed to the sun.

D. Stack all materials to prevent damage and to allow for adequate ventilation.

1.8 WARRANTY

A. Paint finish shall have a twenty year guarantee against cracking, peeling and fade (not to exceed 5 N.B.S. units).

B. Galvalume material shall have a twenty year guarantee against failure due to corrosion, rupture or perforation.

C. Applicator shall furnish warranty covering watertightness of the wall system for the period of two (2) years from the date of substantial completion.

1.9 MANUFACTURER DETAILS: Refer to http://www.berridge.com/downloads/ for manufacturer details for wall and soffit panels in this section.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Berridge Manufacturing Company, Houston, Texas.

B. MCBI, Houston, Texas

C. Fabral, Lancaster, Pennsylvania

D. Substitutions shall fully comply with specified requirements.

2.2 SHEET MATERIALS

A. Prefinished Metal shall be Hot-Dipped Galvanized - ASTM A446-85 Grade C G90 Coating A525-86 24 Gauge core steel or prefinished Galvalume - ASTM 792-86 AZ-55.

B. Unfinished Metal shall be Grade C Galvalume ASTM 792-86, AZ 55, "Satin Finish".

C. Finish shall be full strength Kynar 500 Fluoropolymer coating coating, applied by the manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.70 to 0.90 mil over 0.25 to 0.35 mil prime coat, to provide a total dry film thickness of 0.95 to 1.25 mil. Bottom side shall be coated with primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesion, flexibility, and longevity as specified by the Kynar 500 finish supplier.

D. Strippable film shall be applied to the top side of the painted coil to protect the finish during fabrication, shipping and field handling. This strippable film must be removed before installation.

E. Trim & Flashing: Provide and install trim, flashing and closure pieces to prevent intrusion of water, wind, vermin and bats.

2.3 ACCESSORY MATERIALS

A. Fasteners: Galvanized Steel with washers where required.

2.4 FABRICATION

A. All exposed adjacent flashing shall be of the same material and finish as the wall panels.

B. Hem all exposed edges of flashing on underside, 1/2 inch.

2.5 PANELS: Provide wall & soffit panels of profile noted in the drawings. Fastener spacing and type to be determined by manufacturer's standard offering. Panels shall be longest length possible to minimize endlaps. Panel end splices (when required) shall be over a structural member and shall be a 4" minimum lap. Corner trim, base trim and transition flashings shall be provided as required to complete the wall assembly. Closures and fasteners shall be provided as required for a weathertight installation. Panel types are as follows:

2.6 EXPOSED FASTENER WALL PANEL: The ribbed wall panel shall be precision roll-formed to provide 36" net coverage from 26-gauge, 50,000 PSI minimum yield steel. The panels shall be MBCI PBU Panel, or equal as approved by Architect prior to bidding.

Panel sidelaps shall be formed by lapping major ribs at the panel edges. The underlapping rib shall have full bearing legs to support the sidelap. Manufacturer's standard G-90 galvanized coating with standard color Dextar 850 premium thermoset silicon polyester finish, color selected by Architect.

2.7 SOFFIT PANELS: The ribbed wall panel shall be Berridge Manufacturing Co Vee-Panel, or equal as approved by Architect prior to bidding. Panel coverage width to be 12.75", with a panel depth of 3/8". Ribs to be spaced 4.25" on center. Panels to be of interlocking design with concealed fasteners. Color selected by Architect from all color options including metallic colors.

PART 3 - EXECUTION

3.1 INSPECTION

A. Substrate:
   1. Examine substrate to ensure proper attachment to framing.
   2. Inspect substrate to verify it is clean and smooth, free of depressions, waves or projections, level to +/- ¼" in 20'.

3.2 INSTALLATION

A. Comply with manufacturers standard instructions and conform to standards set forth in the Architectural Sheet Metal Manual published by SMACNA, in order to achieve a watertight installation.

B. Install panels & waterproof membrane in such a manner that horizontal lines are true and level and vertical lines are plumb.

C. Install starter and edge trim before installing panels.

D. Remove protective strippable film prior to installation of panels.

E. Attach panels using manufacturer's standard clips and fasteners, spaced in accordance with approved shop drawings.

F. Do not allow panels or trim to come into contact with dissimilar materials.

G. Protect installed panels and trim from damage caused by adjacent construction until completion of installation.

H. Remove and replace any panels or components which are damaged beyond successful repair.

3.3 CLEANING

A. Clean any grease, finger marks or stains from the panels per manufacturer's recommendations.

B. Remove all scrap and construction debris from the site.

3.4 FINAL INSPECTION

A. Final inspection & approval of installation will be performed by manufacturer’s representative.

07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY: This Section includes sheet metal flashing and trim in the following categories:
- A. Exposed trim, gravel stops, and fasciae (other than that under Division 13).
- B. Copings.
- C. Metal flashing.
- D. Reglets.

1.3 PERFORMANCE REQUIREMENTS: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing. Fabricate and install flashings at roof edges to comply with recommendations of FM Loss Prevention Data Sheet 1-49 for the local wind zone.

1.4 SUBMITTALS: Submit each item in this Article according to the Conditions of the Contract and Division 1 - Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product. Shop Drawings of each item specified showing layout, profiles, methods of joining, and anchorage details.

1.5 QUALITY ASSURANCE: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.6 PROJECT CONDITIONS: Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 METALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of Mill-Finish Alclad Aluminum Sheet: ASTM B 209Alclad 3003-H14, with a minimum thickness of 0.040 inchunless otherwise indicated.

B. Stainless-Steel Sheet: ASTM A 167, Type 304, soft annealed, with No. 2D finish, except where harder temper is required for forming or performance; minimum 0.0187 inch thick, unless otherwise indicated.

C. Galvanized Steel Sheet: ASTM A 526, G 90commercial quality, or ASTM A 527, G 90lock-forming quality, hot-dip galvanized steel sheet with 0.20 percent copper, mill phosphatized where indicated for painting; not less than 0.0396 inchthick, unless otherwise indicated.

D. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ-50 coating, Grade 40or to suit project conditions, with 55 percent aluminum, not less than 0.0396 inchthick, unless otherwise indicated.

2.2 CONCEALED THROUGH-WALL SHEET METAL FLASHING: Fabricate from Stainless Steel 0.0156 inch thick. Fabricate through-wall metal flashings embedded in masonry with ribs formed in dovetail pattern at 3-inch intervals along length of flashing to provide a 3-way integral mortar bond and weep-hole drainage.

2.3 REGLETS: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces and compatible with flashing indicated.

A. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

B. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.

C. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

D. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.

E. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.

F. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of the counterflashing lower edge.

G. Thickness: Material: Stainless steel, 0.0187 inch thick.

H. Material: Aluminum, 0.024 inch thick.

I. Material: Galvanized steel, 0.0217 inch thick.

2.4 FABRICATION, GENERAL: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints). Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer. Size as recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.5 SHEET METAL FABRICATIONS: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.

A. Exposed Trim, Gravel Stops, and Fasciae: Fabricate from Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

B. Copings: Fabricate from Aluminum-Zinc Alloy-Coated Steel: 0.0396 inch thick.

C. Base Flashing: Base flashing equal to 30 ml Nervastral.

D. Counterflashing: Fabricate from Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch thick.

E. Flashing Receivers: Fabricate from Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch thick.

F. Valley Flashing: Fabricate from Coil-Coated Galvanized Steel: 0.0276 inch thick.

G. Drip Edges: Fabricate from Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch thick.

H. Eave Flashing: Fabricate from Aluminum-Zinc Alloy-Coated Steel: 0.0217 inch thick.

I. Equipment Support Flashing: Fabricate from Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

J. Roof-Penetration Flashing: Fabricate from Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

K. Roof Expansion-Joint Cover: Fabricate from Aluminum-Zinc Alloy-Coated Steel: 0.0276 inch thick.

L. Roof-to-Wall Expansion-Joint Cover: Fabricate from Aluminum-Zinc Alloy-Coated Steel: 0.0336 inch thick.

2.6 COIL-COATED GALVANIZED STEEL SHEET FINISH: Manufacturer's standard 2-coat, thermocured system composed of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 605.2. Color and gloss as selected by Architect from manufacturer's full range of choices for color and gloss.

PART 3 - EXECUTION

3.1 EXAMINATION: Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.

B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

C. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

D. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches, except where pretinned surface would show in finished Work. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

E. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant. Use joint adhesive for nonmoving joints specified not to be soldered.

F. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder. For aluminum, fabricate nonmoving seams in aluminum with flat-lock seams; Form seams and seal with epoxy seam sealer; Rivet joints for additional strength.

G. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer. Where installing stainless steel or aluminum directly on cementitious or wood substrates, install a slip sheet of red-rosin paper and a course of polyethylene underlayment. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.

H. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of 2 inches and bed with sealant. Coordinate installation of reglets in substrate to receive counterflashing.

I. Equipment Support Flashing: Coordinate equipment support flashing installation with roofing and equipment installation. Weld or seal flashing to equipment support member.

J. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows: Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing; Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.

3.3 CLEANING AND PROTECTION: Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

07 65 26 - SELF ADHERING SHEET WATERPROOFING & FLASHING

PART 1 - GENERAL

1.1 GENERAL COMMENTS

A. The general and special conditions of these specifications shall both be considered as a part of this section insofar as they may be termed applicable whether attached or not.

B. Cooperation by the contractor for work of this section of the specifications with all other trades is mandatory, so that all phases of the work may be properly coordinated without delays or damage to any parts of any work.

C. The contractor shall provide all items, materials, operations listed or scheduled on the drawings and/or herein, including all labor, materials, equipment and incidentals necessary for their completion.

1.2 SUMMARY

A. As indicated in the drawings, provide membrane flashing for wall panel & roofing applications including valleys, base/wall conditions, eaves and gables.

B. As dampproofing at all metal panel on plywood or gypsum sheathing.

C. As dampproofing at exterior thin brick veneer.

1.3 SUBMITTALS

A. Submit for approval samples, product data, mock-ups, warranty, extra stock.

1.4 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Membrane flashing:

1. Basis of Design: Grace Construction Products

B. Physical properties

1. Meet the physical properties and performance characteristics indicated in table below:

PHYSICAL PROPERTIES OF GRACE UNDERLAYMENTS	
Property and Test Method	Grace Ice & Water Shield
Color	Gray – Black
Thickness membrane, ASTM D3757, Method A	1.02 mm (40 Mil)
Tensile strength, membrane ASTM D412 (Die C Modified)	1720 kPa (250 psi)
Elongation, membrane ASTM D412 (Die C modified)	250%
Low temperature flexibility, ASTM D 1970	Unaffected at -29°
Adhesion to plywood, ASTM D903	525 N/m (3lb/in width)
Permeance (max), ASTM E96	
Material weight installed (max), ASTM D461	1.3 kg/m² (0.3 lb/ft² max)

C. Fire rating

1. Underwriters Laboratories, Inc. (UL)

a. UL R13399 Class A fire classification under fiberglass shingles and Class C under organic felt shingles for Grace Ice and Water Shield.

b. UL Classified Sheathing Material Fire Resistance Classification Design Numbers P225, P227, P230, P237, P259, P508, P510, P512, P514, P701, P711, P717, P722, P723, P722, P723, P734, P736, P742, P803, P814, P818 and P824 for Grace Ice & Water Shield.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Surface Preparation: Install underlayments directly on a clean, dry, continuous substrate. Remove dust, dirt, loose nails and extraneous materials. Protrusions from the substrate area must be removed. Substrates shall have no voids, damaged or unsupported areas. Repair substrate areas before installing the membrane.

B. Membrane Installation

1. Apply Grace underlayments only in fair weather when the air, substrate and membrane are at temperatures of 5 degrees C (40 degrees F) or higher. Apply covering material at temperatures of 5 degrees C (40 degrees F) or higher.

2. Consistent with good construction practice, install the membrane so that all laps shed water. Always work from the low point to the high point of the assembly. At roof applications apply the membrane in valleys before the membrane is applied to the eaves; following placement along the eaves, continue application of the membrane up the roof. The membrane may be installed either vertically or horizontally.

3. Use smooth shank, electroplated galvanized nails for fastening shingles. Hand nailing will provide a better seal than power activated nailing. If nailing of the membrane is necessary on steep slopes during hot weather, backnail and cover the nails by overlapping with the next sheet.

4. Extend the membrane on the substrate above the highest expected level of water back-up from ice dams and above the highest expected level of snow and ice on the wall sheathing on vertical side walls (dormers) and vertical front walls for ice dam protection. Consider a double layer of membrane in critical areas, such as along the eaves or in valleys, in climates where severe ice dams are anticipated. Apply the membrane to the entire substrate for wind driven rain protection. Apply a new layer of Grace underlayment directly over the old Grace underlayment in retrofit applications following the standard membrane application procedure. Place metal drip edges or wood starter shingles over the membrane.

07 84 13 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY: Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

1.2 PERFORMANCE REQUIREMENTS

A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

a. Penetrations located outside wall cavities.

b. Penetrations located outside fire-resistance-rated shaft enclosures.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each through-penetration firestop system, submit documentation, including illustrations, from a qualified testing and inspecting agency, showing each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item.

C. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

D. Qualification Data: For Installer.

1.4 QUALITY ASSURANCE

A. Installation Responsibility: Assign installation of through-penetration firestop systemsin Project to a single qualified installer.

B. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 “Performance Requirements” Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

2. Through-penetration firestop systems are identical to those tested per testing standard referenced in “Part 1 Performance Requirements” Article. Provide rated systems bearing classification marking of qualified testing and inspecting agency.

C. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated that are produced by one of the following manufacturers:
1. Grace, W. R. & Co. -Conn.
2. Hilti, Inc.
3. Johns Manville.
4. RectorSeal Corporation (The).
5. Tremco; Sealant/Weatherproofing Division.
6. USG Corporation.

2.2 FIRESTOPPING

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 “Performance Requirements” Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.

PART 3 - EXECUTION

3.1 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 “Performance Requirements” Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

D. Identification: Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. Include the following information on labels:

1. The words “Warning -Through-Penetration Firestop System -Do Not Disturb. Notify Building Management of Any Damage.”

2. Contractor's name, address, and phone number.

3. Through-penetration firestop system designation of applicable testing and inspecting agency.

4. Date of installation.

5. Through-penetration firestop system manufacturer's name.

6. Installer's name.

3.2 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage an independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY: This Section includes sealants for the following applications, including those specified by reference to this Section:

A. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
1. Control and expansion joints in cast-in-place concrete.
2. Joints between architectural precast concrete units.
3. Control and expansion joints in unit masonry.
4. Joints between metal panels.
5. Joints between different materials listed above.
6. Perimeter joints between materials listed above and frames of doors and windows.
7. Control and expansion joints in ceiling and overhead surfaces.
8. Other joints as indicated.

B. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
1. Control and expansion joints on exposed interior surfaces of exterior walls.
2. Perimeter joints of exterior openings where indicated.
3. Tile control and expansion joints.
4. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
5. Joints on underside of precast beams and planks.
6. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
7. Joints between plumbing fixtures and adjoining walls, floors, and counters.
8. Other joints as indicated.

C. Interior joints in the following horizontal traffic surfaces:
1. Control and expansion joints in cast-in-place concrete slabs.
2. Control and expansion joints in tile flooring.
3. Other joints as indicated.

1.3 PERFORMANCE REQUIREMENTS: Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS: Product Data for each joint-sealant product. Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view. For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

1.5 QUALITY ASSURANCE: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Obtain each type of joint sealant through one source from a single manufacturer. Before installing elastomeric sealants, field test their adhesion to joint substrates.

1.6 DELIVERY, STORAGE, AND HANDLING: Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.7 PROJECT CONDITIONS: Do not proceed with installation of joint sealants when ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer, or when joint substrates are wet. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience. Colors of exposed joint sealants as selected by Architect from manufacturer's full range for this characteristic.

2.2 ELASTOMERIC JOINT SEALANTS:Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant, including those referencing ASTM C 920 classifications for type, grade, class, and uses. Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project. Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

A. Multicomponent Nonsag Polysulfide Sealant: Provide products equal to Thiokol 2P; Morton International, Inc. or Two-Part Sealant; Sonneborn Building Products Div., ChemRex Inc.

B. Multicomponent Pourable Polysulfide Sealant: Provide products equal to Deck-O-Seal by W.R. Meadows, Inc.

C. Medium-Modulus Neutral-Curing Silicone Sealant: Provide products equal to Dow Corning or Tremsil 600 Tremco.

D. Single-Component Nonsag Urethane Sealant: Provide products equal to Sikaflex 1A by Sika Corporation or NP 1 by Sonneborn Building Products Div., ChemRex Inc.

E. Single-Component Pourable Urethane Sealant: Provide products equal to Vulkem by Mameco International, or SL 1 by Sonneborn Building Products Div., ChemRex Inc.

2.3 SOLVENT-RELEASE JOINT SEALANTS: Comply with ASTM C 1311.

2.4 PIGMENTED NARROW JOINT SEALANT: Provide manufacturer's standard, solvent-release-curing, pigmented, synthetic-rubber sealant complying with AAMA 803.3 and formulated for sealing joints 3/16 inch or smaller in width.

2.5 LATEX JOINT SEALANTS: Comply with ASTM C 834 for each product of this description. Provide products equal to Sonolac by Sonneborn Building Products Div., ChemRex, Inc., or Tremflex 834 by Tremco.

2.6 ACOUSTICAL JOINT SEALANTS: For each product of this description, provide manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90. Provide products equal to AC-20 FTR Acoustical and Insulation Sealant; Pecora Corporation, or SHEETROCK Acoustical Sealant; USG Corp., United States Gypsum Co.

2.7 JOINT-SEALANT BACKING: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

2.8 MISCELLANEOUS MATERIALS: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests. Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.

PART 3 - EXECUTION

3.1 EXAMINATION: Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces. Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply. Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated. Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints. Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

3.4 CLEANING: Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION: Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

DIVISION 08 – OPENINGS

08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 DESCRIPTION: Provide metal doors, and metal door and window frames, which are not specifically described in other Sections of these Specifications, where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

1.3 QUALITY ASSURANCE: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.4 JOB CONDITIONS: Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

1.5 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

PART 2 - PRODUCTS

2.1 METAL DOORS: Provide full-flush design, in dimensions and types shown on the Drawings, labeled or non-labeled as indicated on the Drawings, in 18 gage for interior doors and 16 gage for exterior doors, properly reinforced for the finish hardware described. Pre-clean and shop prime each door for finish painting which will be performed at the job site. Acceptable manufacturers are Steelcraft Manufacturing Company, Amweld Division of American Welding and Manufacturing Company, Ceco Corporation, Curries Company, or other manufacturers when approved in advance by the Architect.

2.2 METAL FRAMES: Provide frames of the types and dimensions shown on the Drawings, labeled or non-labeled as indicated on the Door Schedule in the Drawings, in 18 gage for interior doors and 16 gage for exterior doors, fully-welded, properly reinforced for the finish hardware described. Pre-clean and shop prime each frame for finish painting which will be performed at the job site. Manufacturer to be same as door.

2.3 FINISH HARDWARE: Secure templates from the finish hardware supplier, and accurately install, or make provision for, all finish hardware at the factory. Refer to section 08 71 00.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION: Where practicable, place frames prior to construction of enclosing walls and ceilings. Set frames accurately into position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged. At in-place construction, set frames and secure to adjacent construction with machine screws and suitable anchorage devices. Provide "Z" fillers at each screw location.

3.3 ADJUST AND CLEAN: Check and readjust operating finish hardware items in hollow metal work just prior to final inspection. Leave work in complete and proper operating condition. Remove defective work and replace with work complying with the specified requirements. Immediately after erection, sand smooth all rusted and damaged areas of prime coat, and apply touchup of compatible air-drying primer.

08 14 23 - PLASTIC-LAMINATE-FACED WOOD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION: Furnish all labor, materials, tools, & equipment as required for all PLASTIC LAMINATED WOOD DOORS, as shown on the Drawings, specified herein, and as needed for a complete and proper installation. Conform to Industry Standard ANSI/NWMA IS 1-80 and additional requirements given below.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section. The requirements of other sections may affect the work under this section.

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

1.4 PRODUCT HANDLING: Protect stored materials against exposure to weather and contact with moisture, providing air good circulation.

1.5 QUALITY ASSURANCE: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years.

1.6 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

1.7 WARRANTY: Interior doors shall be warranted for five years. Warranty shall include finishing, hanging, and installing hardware if defect was discovered after door was finished and installed.

PART 2 - PRODUCTS

2.1 INTERIOR DOORS: Interior Doors to be solid core plastic laminated, AWI Spec Symbol PC-5, Flush. 1-3/4 inch doors shall have hardwood edge & 5 ply, 28 to 32 lb density cores meeting requirements of ANSI A 208.1 "Mat Formed Wood Particle Board" grade 1-L-1. Face & exposed edges to be high pressure applied plastic laminate.

2.2 PLASTIC LAMINATE: Plastic laminate to be .05" thick, by Wilsonart or Formica. Color selected by Architect.

A. LAMINATE MANUFACTURER COORDINATION: Laminate manufacturer to be same for following systems:

1. 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK
2. 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS
3. 06 41 17 - PLASTIC-LAMINATE-CLAD ADJUSTABLE SHELVING
4. 08 14 23 - PLASTIC-LAMINATE-FACED WOOD DOORS
5. 10 12 00 - STOREFRONT DISPLAY CASES

2.3 VISION PANELS: Painted steel framed glazed panel. Provide fire glass at doors to corridor and other fire rated assemblies; no wired glass allowed.

2.4 FIRE RATING: Doors at fire rated assemblies to be rated per the wall assembly. For example, at 1-hour rated corridor walls, door assembly to be labeled 20 minute.

2.5 FINISH HARDWARE: Secure templates from the finish hardware supplier, and accurately install, or make provision for, all finish hardware at the factory. Refer to section 08700. Hardware at fire rated assemblies to be rated per the wall assembly.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct condition detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected. Coordinate

this work with interfacing work to ensure proper sequencing. Inspect installed work of other trades and verify its completion to a point where this work may continue.

3.2 INSTALLATION: Install this work in strict accordance with the original design, requirements of governmental agencies having jurisdiction, and the manufacturer's recommendations as accepted by the Architect. Securely install plumb, level, without racking.

08 14 23 - ATTACK RESISTANT DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.

2. Details of doors, including vertical and horizontal edge details and metal thicknesses.

3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware.

5. Details of anchorages, joints, field splices, and connections.

6. Details of accessories.

7. Details of moldings, removable stops, and glazing.

8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification: Samples are only required by request of the architect.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors'.

D. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.4 SECURITY TESTING AND METHODOLOGY REQUIREMENTS

A. Attack Resistant Doors and Attack Resistant Retro-Fit Kits: Door systems (system defined as door, door frame, hardware, glass kit and glass) independently tested by a third party testing company according to Test 5-aa10 -

Certification Standards for Reinforcing and Testing of Standard Wood and Hollow Metal Doors, Frames, Glass and Hardware based on the FBI's Active Shooter Report.

B. Attack Resistant doors and surrounding frames and sidelights to demonstrate the ability, through independent third party testing or independent third party test report, to provide the following attributes:

1. Products tested as a whole system, including glass, hardware, doors and frames. Borrowed lite and sidelight frames to be third party tested or defined in third party test report.

2. Products tested are full size, actual doors and framing members usable in a commercial setting, as applicable to project requirements, with glazing installed as prescribed by the glazing manufacturer. Testing will not include any framing, doors, glass kits or other components other than what is specified in regards to quality or manufacturer as stated in the Contract Documents.

3. Glass bite during testing to be no more than the allowable glass bite in the specified door or framing system for this project.

4. Glass to resist attack for a minimum of 4 minutes (after being subjected to ballistic testing according to Test 5-aa10) to meet the desired level of protection required by the Test 5-aa10 standard.

5. Attack duration to be continuous. Breaks between testing phases shall not be counted or timed for total duration.

6. Glass to be integrated into a framing system in such a way that the frame and glass are able to withstand a constant attack for 4 minutes.

7. Attack resistance to of the glazing and door hardware and borrowed lite or sidelight is subjected to the following without failure:

a. Latching hardware to withstand 30 shots from a military style assault rifle with a minimum caliber of 7.62mm according to Test 5-aa10.

b. Door glazing to withstand 30 shots from a military style assault rifle with a minimum caliber of 7.62mm according to Test 5-aa10.

c. Borrowed lites or sidelights to withstand 30 shots from a military style assault rifle with a minimum caliber of 7.62mm according to Test 5-aa10.

d. Following ballistic testing per Test 5-aa10. Latching hardware, door glazing, borrowed lites and sidelights to withstand a minimum of abuse as applied by a single assailant at full force and including strikes with blunt objects without stoppage for 4 minutes according to Test 5-aa10 standards.

C. Failure is defined as the attacker being able to gain entry through the door or glazed opening.

D. Product to not be easily damaged or scratched by scissors, writing implements, razor blades or the use of any similar sharp object.

E. Glass shall not have an optical haze of more than 1.8%.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

D. Package pre-finished doors individually in plastic bags and wrap bundles of doors in plastic sheeting.

E. Mark each door on top rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

B. Environmental Limitations: Do not deliver or install wood doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors and frame units that fail in materials or workmanship within specified warranty period.

B. Additional Warranty for Wood Doors:

1. Failures include, but are not limited to, the following:

a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.

b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in an inch span.

2. Warranty Period for Solid Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.2 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CECO Door Products (C).

2. Curries Company (CU).

C. Interior Attack Resistant Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level. Provide doors, frames, hardware and glass, tested as a single unit, that conform to test 5-aa10.

1. Design: Flush panel.

2. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 1.

3. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).

4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.

6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

7. Hardware: Refer to section 087100. Only hardware which has been successfully tested with the door assembly is permitted.

2.3 WOOD VENEER DOORS

A. Interior Attack Resistant Doors: Provide doors, frames, hardware and glass, tested as a single unit, that conform to test 5-aa10.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium

C. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Graham (GR): GPD Series.

D. Structural Composite Lumber Core Doors:

1. Structural Composite Lumber: Engineered hardwood composite wood products tested in accordance with WDMA I.S.1A, Testing Cellulosic Composite Materials for Use in Fenestration Products containing no added Urea Formaldehyde.

2. LEED: Meet requirements of IEQ4.4.

E. Blocking:

1. Provide blocking as indicated below:

a. HB1: 5 inch top rail in doors indicated to have closers or overhead stops.

b. HB3: 5 inch bottom rail blocking in doors indicated to have kick plates.

c. HB7: 5 inch stile blocking.

F. Interior Solid Core Doors:

1. Grade: Premium.

a. Plastic laminate to match existing.

2. Vertical Edges: Plastic laminate. Wood or composite material, one piece, laminated. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.

3. Horizontal Edges: Solid wood or structural composite material meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors

4. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.

5. Doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.

2.4 LIGHT OPENINGS AND GLAZING

A. Metal Frames for Light Openings: Manufacturer standard formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish.

B. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

1. Factory Glazing: Factory install security glass in doors as indicated. Doors with factory installed glass to include all required glazing material.

2. Glazing must comply with the following requirements:

a. ANSI Z97.1 - Safety Performance Specifications and Methods of Test for Safety Glazing Used in Buildings.

b. Independent testing of glazing conforming to criteria 5-aa10 and 5-aa1 is required.

3. Security Glazing: Basis-of-Design Product: SG5 by School Guard Glass as manufactured by Laminated Technologies Inc.

a. 5-aa1 rated for a minimum of 12 minutes.

b. Glass clad interior and exterior surfaces of no less than 3.2mm.

c. Optical haze of no more than 1.8%.

d. Blast rating shall be 10 psi/89 psi-msec for pieces up to 24" x 48".

2.5 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.

2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing.

3. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

4. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

D. Hollow Metal Frames:

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

   a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

2. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.

4. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.

5. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with loose wiring harness (not attached to open throat components or installed in closed mullion tubes) and standardized Molex™ plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".

6. Electrical Knock Out Boxes: Factory weld 18 gauge electrical knock out boxes to frame for electrical hardware preps; including but not limited to, electric through wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware".

   a. Provide electrical knock out boxes with a dual 1/2-inch and 3/4-inch knockouts.

   b. Conduit to be coordinated and installed in the field (Division 26) from middle hinge box and strike box to door position box.

   c. Electrical knock out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware".

   d. Electrical knock out boxes for continuous hinges should be located in the center of the vertical dimension on the hinge jamb.

7. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

8. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

i Two anchors per jamb up to 60 inches high.

ii Three anchors per jamb from 60 to 90 inches high.

iii Four anchors per jamb from 90 to 120 inches high.

iv Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

9. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.

2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.

3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.

4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.6 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.

3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.

4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

D. Veneer Wood Doors: Install doors and frames to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Factory Fitted Doors: Align in frames for uniform clearance at each edge.

2. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3. Field modifications to doors shall not be permitted, except those specifically allowed by manufacturer or fire rating requirements.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

D. Finished Veneer Wood Doors: Replace doors that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

08 36 00 - SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.1 DESCRIPTION: Provide insulated sectional overhead doors for commercial applications. Submit for approval shop drawings, product data. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section. Comply with governing codes and regulations.

1.3 SUBMITTALS: Submit promptly complete product information on this section to the A/E for review. Provide a copy of the manufacturer's standard warranty.

PART 2 - PRODUCTS

2.1 INSULATED SECTIONAL OVERHEAD DOORS

A. Overhead Coiling Commercial Sheet Doors: Overhead Door Corporation 426 Series.

1. Door Assembly: Insulated steel door assembly with rabbeted meeting rails to form weathertight joints and provide full-width interlocking structural rigidity.

a. Panel Thickness: 2 inches (51 mm).

b. Exterior Surface: Ribbed.

c. Exterior Steel: 24 gauge, hot-dip galvanized.

d. Back Cover:

i 26 gauge steel.

ii Poly-Backed.

iii High Impact Polystyrene Backcover.

e. Center and End Stiles: 16 gauge steel.

f. Springs:

i 25,000 cycles.

g. Insulation: Polystyrene.

h. Thermal Values:

i Polystyrene - R-value of 7.35; U-value of 0.136.

i. Finish and Color: Two coat baked-on polyester with white exterior and white interior color.

j. Windload Design: Provide to meet the Design/Performance requirements specified.

k. Hardware: Galvanized steel hinges and fixtures. Ball bearing rollers with hardened steel races.

l. Lock:

i Interior mounted slide lock. (Where manual operation)

ii Interior mounted slide lock with interlock switch for automatic operator. (where motorized operation)

m. Weatherstripping:

i Flexible bulb-type strip at bottom section.

ii Flexible Jamb seals.

iii Flexible Header seal.

n. Track: Provide track as recommended by manufacturer to suit loading required and clearances available.

o. Operation:

i Door 509C amd 509E to be manual operation: Chain Hoist.

ii Doors 509B and 509D to be electric motor operation: Provide UL listed electric operator, size and type as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second. Operator shall meet UL325/2010 requirements for continuous monitoring of safety devices.

- Entrapment Protection: Required for momentary contact, includes radio control operation.
    - Pneumatic sensing edge up to 18 feet (5.5 m) wide. Constant contact only complying with UL 325/2010.
    - Electric sensing edge monitored to meet UL 325/2010.
    - Photoelectric sensors monitored to meet UL 325/2010.
- Operator Controls:
    - Push-button operated control stations with open, close, and stop buttons.
    - Surface mounting.
    - Interior location.

2.2 GLAZING: Provide glazing panels as indicated.

2.3 ACCESSORIES: Provide each door with lock, to be pin tumbler single-unit mechanism, & PVC bottom & side weatherseal held in place by retainer.

PART 3 - EXECUTION

3.1 PREPARATION: Examine the areas and conditions under which work of this Section will be performed & correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected. Take field measurements before fabrication where possible; do not delay job progress.

3.2 INSTALLATION: Deliver, handle, and store materials in accordance with manufacturer's instructions. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation

with adjacent construction and with uniform appearance. Securely mount to structure, plumb & level. Coordinate with work of other sections. Install assemblies complete with all hardware, anchors, inserts, supports and accessories. Restore damaged finishes and test for proper operation. Clean and protect work from damage.

08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Kawneer Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

1. Types of Kawneer Aluminum Storefront Systems include:

a. Trifab® VG 451 Storefront System – 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension; Non-Thermal; Front, Center, Back, Multi-Plane, Structural Silicone or Weatherseal Glazed (Type B); Screw Spline, Shear Block, Stick or Punched Opening Fabrication.

b. Trifab® VG 451T Storefront System – 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension; Thermal; Front, Center, Back, Multi-Plane, Structural Silicone or Weatherseal Glazed (Type B); Screw Spline, Shear Block, Stick or Punched Opening Fabrication.

1.3 DEFINITIONS

A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufactures Association (AAMA) – AAMA Glossary (AAMA AG).

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed storefront system shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Design Wind Loads: Determine design wind loads applicable to the Project from basic wind speed indicated in miles per hour, according to ASCE 7, Section 6.5, "Method 2-Analytical Procedure," based on mean roof heights above grade indicated on Drawings.

B. Storefront System Performance Requirements:

1. Wind loads: Per local IBC requirements.

2. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft2 (0.3 l/s • m2) at a static air pressure differential of 6.24 psf (300 Pa).

3. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 8 psf (383 Pa) as defined in AAMA 501.

4. Uniform Load: A static air design load of 20 psf (958 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

5. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than:

a. Glass to Exterior – 0.47 (low-e) or 0.61 (clear)

b. Glass to Center – 0.44 (low-e) or 0.61 (clear)

c. Glass to Interior – 0.41 (low-e) or 0.56 (clear)

6. Windborne-Debris-Impact-Resistance Performance: Shall be tested in accordance with ASTM E 1886 and information in ASTM E 1996 and /or AAMA 506.

a. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.

b. Small-Missile Impact: For aluminum-framed systems located more than 30 feet (9.1 m) above grade.

1.5 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum frame storefront system indicated.

B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.

C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.

D. Samples for Verification: For aluminum framed storefront system and components required.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type of aluminum-framed storefront.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12” (300 mm) lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.

2. Anchorage.

3. Expansion provisions.

4. Glazing.

5. Flashing and drainage.

G. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications: A manufacturer capable of providing aluminum framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.

C. Source Limitations: Obtain aluminum framed storefront system through one source from a single manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum framed storefront system and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup for type(s) of storefront elevation(s) indicated, in location(s) shown on Drawings.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

G. Structural-Sealant Glazing: Comply with ASTM C 1401, "Guide for Structural Sealant Glazing" for design and installation of structural-sealant-glazed systems.

H. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of aluminum framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

1.8 MANUFACTURER'S WARRANTY: Submit, for Owner's acceptance, manufacturer's standard warranty. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product:

1. Kawneer Company Inc.

2. Interior: Trifab® VG 451 (non-Thermal) Storefront System

3. Exterior: Trifab® 451T (thermal) Storefront System

4. Glass: Center

B. Substitutions: Refer to Substitutions Section for procedures and submission requirements

1. Pre-Contract (Bidding Period) Substitutions: Submit written requests ten (10) days prior to bid date.

2. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.

3. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum storefronts for a period of not less than ten (10) years. (Company Name)

4. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.

5. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.

C. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

D. Approved Manufacturers:

1. Oldcastle BuildingEnvelope

2. Tubelite, Inc.

2.2 MATERIALS

A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.

B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.

E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

2.3 STOREFRONT FRAMING SYSTEM

A. Thermal Barrier (Trifab® VG 451T):

1. Kawneer IsoLock® Thermal Break with a 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.

a. Thermal Break shall be designed in accordance with AAMA TIR-A8 and tested in accordance with AAMA 505.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.

D. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action

E. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

F. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:

1. Structural Sealant: ASTM C 1184, single-component neutral-curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by a structural-sealant manufacturer for use in aluminum-framed systems indicated.

a. Color: Black

2. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.

a. Color: Matching structural sealant.

2.5 ALUMINUM ENTRANCES

A. Exterior Aluminum Entrances: Basis of Design: Kawneer 560 Insulclad Wide Stile Thermal Entrances

B. Interior Aluminum Entrances: Basis of Design: Kawneer 500 Standard Wide Stile Entrances

C. Aluminum Entrance Hardware: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated. Finish exposed parts to match door finish, unless otherwise indicated. Hardware to be supplied by Division 08710 and installed by this division.

1. Offset Pivots: ANSI/BHMA A156.4, Grade 1 with exposed parts of cast-aluminum alloy. Provide top, bottom and intermediate pivots at each door leaf.

2. Closers, General: Comply with manufacturer’s recommendations for closer size, depending on door size, exposure to weather and anticipated frequency of use.

a. Closing Cycle: Comply with requirements of authorities having jurisdiction or the Americans with Disabilities Act (ADA), “Accessibility Guidelines for Buildings and Facilities (ADAAG), “whichever are more stringent.

b. Opening Force: Comply with the following maximum opening-force requirements for locations indicated:

i Exterior Doors: 15 lbf (67 N).

ii Interior Doors: 5 lbf (22.2N).

3. Surface-Mounted Overhead Closers: ANSI/BHMA A156.4, Grade 1. Provide cover and the following:

   a. Mounting: Push side.

   b. Hold Open: Automatic, at angle selected by Architect from manufacturer's standard options (when indicated on door schedule).

   c. LCN, Norton, Dorma.

4. Door Stops: ANSI/BHMA A156.16, Grade 1, floor- or wall-mounted door stop, as appropriate for door location indicated, with integral rubber bumper.

5. Cylinders: As specified in Division 8 Section "Door Hardware".

6. Cylinder Guard: Manufacturer's standard hardened-steel security ring with retainer plate for inside stile wall that protects lock cylinder from removal by wrenches, prying, or sawing.

7. Vertical-Rod Exit Devices: Concealed, vertical-rod exit device complying with UL305 requirements, with 2-point top and bottom latching that is released by a full-width panel line exit device or when locked down (dogged) by retracting screws beneath housing. Provide electrified option for card access requirements.

   a. Von Duprin, Monarch.

8. Removable Mullions: Manufacturer's standard aluminum or aluminum-clad-steel removable mullion with mullion stabilizers located below latch strikes.

   a. Von Duprin, Monarch.

9. Pull Handles: As selected by Architect from manufacturer's full range of pull handles and plates.

10. Push Bars: As selected by Architect from manufacturer's full range of full-door-width, single-bar push bars.

11. Thresholds: At exterior doors, provide manufacturer's standard threshold with cut-outs coordinated for operating hardware, with anchors and jamb clips, and not more than 1-2-inch- (12.7-mm-) high, with beveled edges providing a floor level change with a slope of not more than 1:2, and in Aluminum, mill finish or bronze mill finish to match entrance finish.

    a. National Guard Products, Pemko, Zero.

12. Weather Sweeps: Manufacturer's standard weather sweep for application to exterior door bottoms and with concealed fasteners on mounting strips.

13. Verify with Architect: interior aluminum doors to have panics and/or deadlocks & push/pulls.

2.6 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

2.7 FABRICATION

A. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.

2. Accurately fit joints; make joints flush, hairline and weatherproof.

3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

4. Physical and thermal isolation of glazing from framing members.

5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

6. Provisions for field replacement of glazing.

7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

B. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

C. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

D. Storefront Framing: Fabricate components for assembly using manufactures standard installation instructions.

E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:

1. Kawneer Permanodic® AA-M12C22A31, AAMA 611, Architectural Class II Clear Anodized Coating (Color #17 Clear)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight framed aluminum storefront system installation.

1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.

2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.

3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.

4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum framed storefront system, accessories, and other components.

B. Install aluminum framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.

D. Install aluminum framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within sliding door to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

3.3 FIELD QUALITY CONTROL

A. Field Tests: Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.

1. Testing: Testing shall be performed by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements. Testing Standard per AAMA 503, including reference to ASTM E 783 for Air Infiltration Test and ASTM E 1105 Water Infiltration Test.

a. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft2, whichever is greater.

b. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.24 psf (300 Pa).

B. Manufacturer's Field Services: Upon Owner’s written request, provide periodic site visit by manufacturer’s field service representative.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Clean aluminum surfaces immediately after installing aluminum framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.

2. Sliding doors.

3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.

2. Electromechanical door hardware.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.

2. Division 08 Section “Plastic Laminate Faced Wood Doors”.

3. Division 08 Section “Attack Resistant Doors and Frames.”

4. Division 28 Section “Access Control”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.

2. ICC/IBC - International Building Code.

3. NFPA 70 - National Electrical Code.

4. NFPA 80 - Fire Doors and Windows.

5. NFPA 101 - Life Safety Code.

6. NFPA 105 - Installation of Smoke Door Assemblies.

7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series

2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.

b. Manufacturer of each item.

c. Fastenings and other pertinent information.

d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.

e. Explanation of abbreviations, symbols, and codes contained in schedule.

f. Mounting locations for door hardware.

g. Door and frame sizes and materials.

h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.

b. Complete (risers, point-to-point) access control system block wiring diagrams.

c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.

2. Plans for existing and future key system expansion.

3. Requirements for key control storage and software.

4. Installation of permanent keys, cylinder cores and software.

5. Address and requirements for delivery of keys.

G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.

3. Review sequence of operation narratives for each unique access controlled opening.

4. Review and finalize construction schedule and verify availability of materials.

5. Review the required inspecting, testing, commissioning, and demonstration procedures

H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.

2. Faulty operation of the hardware.

3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for extra heavy duty cylindrical (bored) locks and latches.

2. Five years for exit hardware.

3. Twenty five years for manual surface door closer bodies.

4. Five years for motorized electric latch retraction exit devices.

5. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

a. Two Hinges: For doors with heights up to 60 inches.

b. Three Hinges: For doors with heights 61 to 90 inches.

c. Four Hinges: For doors with heights 91 to 120 inches.

d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.

b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.

b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

a. Hager Companies (HA).

b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).

2.3 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.

b. Securitron (SU) - EL-CEPT Series.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.

b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

a. Hager Companies (HA) - Quick Connect.

b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.

2. Furnish dust proof strikes for bottom bolts.

3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.

4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

b. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

b. Trimco (TC).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.

2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.

3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.

4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

b. Trimco (TC).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) Elem and High Schools.

b. Sargent Manufacturing (SA) Career Ctr and Middle School.

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.

2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.

3. Bored-Lock Type: Cylinders with tailpieces to suit locks.

4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.

5. Keyway: Match each schools existing keyway.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.

2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.

3. Existing System: Key locks to Owner's existing system.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Three (3).

2. Master Keys (per Master Key Level/Group): Five (5).

3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.

2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified.

1. Furnish with solid cast levers, standard 2 3/4” backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.

2. Locks are to be non-handed and fully field reversible.

3. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.2 requirements to 2 million cycles.

4. Manufacturers:

a. Corbin Russwin Hardware (RU) – CL3300 Series - Elem and High Schools.

b. Sargent Manufacturing (SA) – 10 Line - Career Ctr and Middle School.

2.7 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Cylindrical Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical cylindrical locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock status monitoring, and request-to-exit signaling. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Manufacturers:

a. Corbin Russwin Hardware (RU) - CL33900 Series - Elem and High Schools.

3. Sargent Manufacturing (SA) - 10G71 Series - Career Ctr and Middle School.

2.8 AUXILIARY LOCKS

A. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 certified narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8” diameter bolts.

1. Manufacturers:

a. Adams Rite Manufacturing (AD) - MS1850S / MS1950 Series.

2.9 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.

2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.

3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.

2. Strikes for Bored Locks and Latches: BHMA A156.2.

3. Strikes for Auxiliary Deadlocks: BHMA A156.36.

4. Dustproof Strikes: BHMA A156.16.

2.10 ELECTROMAGNETIC LOCKING DEVICES

A. Surface Electromagnetic Locks (Heavy Duty): Electromagnetic locks to be surface mounted type conforming to ANSI A156.23, Grade 2 with minimum holding force strength of 1,200 pounds. Locks to be capable of accepting between 12 to 24 volts direct current and be UL listed for use on fire rated door assemblies. Electromagnetic coils are to consume no more than 1.5W during normal operation. Locks are to have an integrated door position switch, tamper switch, and lock bond sensor. Locks are to have integrated motion sensor and/or security camera as indicated in the hardware sets. Locks to be capable of detecting door prop conditions and entering low power mode. Provide mounting accessories as needed to suit opening conditions. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty.

1. Manufacturers:

a. Securitron (SU) – M680E Series.

2.11 ELECTRIC STRIKES

A. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.

1. Manufacturers:

a. HES (HS) - 9400 Series

b. HES (HS) - 9500/9600 Series.

2.12 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.

6. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.

7. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.

   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

8. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

9. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.

10. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

11. Extended cycle test: Devices to have been cycle tested in ordinance with ANSI/BHMA 156.3 requirements to 9 million cycles.

12. Rail Sizing: Provide exit device rails factory sized for proper door width application.

13. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

   1. Manufacturers:

      a. Corbin Russwin Hardware (RU) - ED5000 Series - Elem and High Schools.

      b. Sargent Manufacturing (SA) - 80 Series - Career Ctr and Middle School.

C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.

   1. Provide keyed removable feature where specified in the Hardware Sets.

   2. Provide stabilizers and mounting brackets as required.

   3. Provide electrical quick connection wiring options as specified in the hardware sets.

   4. Manufacturers:

      a. Corbin Russwin Hardware (RU) - 700/900 Series - Elem and High Schools.

      b. Sargent Manufacturing (SA) - 980S Series - Career Ctr and Middle School.

2.13 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) - DC6000 Series.

b. Sargent Manufacturing (SA) - 351 Series.

c. Norton Door Controls (NO) - 7500 Series.

2.14 SURFACE MOUNTED CLOSER HOLDERS

A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Manufacturers:

a. Rixson (RF) - 980/990 Series.

b. Sargent Manufacturing (SA) - 1560 Series.

2.15 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on

pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

   a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

   b. Trimco (TC).

2.16 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

   a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

   b. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

   a. Rixson Door Controls (RF).

   b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

   c. Sargent Manufacturing (SA).

2.17 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers:

a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.18 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Security Door Controls (SD) - DPS Series.

b. Securitron (SU) - DPS Series.

B. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Manufacturers:

a. Corbin Russwin Hardware (RU) - BPS Series.

C. Switching Power Supplies: Provide switching power supplies that are dual voltage, UL listed, supervised units. Units shall be field selectable with a dedicated battery charging circuit that provide 4 Amp at 12VDC or 24VDC continuous, with up to 16 independently controlled power limited outputs. Units shall tolerate brownout or overvoltage input ± 15% of nominal voltage and have thermal shutdown protection with auto restart. Circuit breaker shall protect against overcurrent and reverse battery faults and units shall be available with a single relay fire trigger or individually triggered relayed outputs. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Manufacturers:

a. Securitron (SU) - AQ Series.

2.19 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.20 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."

4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in

another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer’s Abbreviations:

1. MK - McKinney

2. RO - Rockwood

3. RU - Corbin Russwin

4. SA - Sargent
5. SU - Securitron
6. AD - Adams Rite
7. HS - HES
8. RF - Rixson
9. NO - Norton
10. PE - Pemko
11. OT - OTHER

3.9 HARDWARE SCHEDULE:

Set: 1.0
Doors: C100A
Description: Ext - Alum - Pair - Rim/nl x Rim/dt x KRM - ELR - HD Par SP Closer

6	Hinge	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK	
1	Removable Mullion	L980S / L980A	PC	SA	
1	Rim Exit Device (elr - night latch)		55 56 8804	US32D	SA
1	Rim Exit Device (elr - exit only)		55 56 8810	US32D	SA
1	Cylinder	980C1	US26D	SA	
2	Pull	RM201 Mtg-Type 1XHD	US32D	RO	
2	Door Closer	CPS7500689	NO		
1	Threshold	252x3AFG MSES25SS		PE	
2	Sweep	315CN	PE		
2	Harness Adaptor	52-2946	SA		
2	Electric Power Transfer	CEPT-10	SU		
2	ElectroLynx Harness	QC-C1500P		MK	
1	Card Reader	By Security Supplier			
2	ElectroLynx Harness	QC-C****	MK		
1	Door Position Switch	DPS2 - M / W-BK		SU	
1	Power Supply	AQD6	SU		

Notes:
Perimeter and meeting stile gasket by door / frame manufacturer.

System Operational Narrative:
- Doors normally closed and secure.
- Access by valid credential presentation retracting latches for a pre-determined time limit and then relocking.
- Egress always free for immediate exit. Request-to-Exit sensors allows exit without alarm condition.
- Door position switches provide open/closed monitoring to both access control system and intrusion alarm service.
- Latches remain projected/locked (fail secure) in event of power loss. Key override cylinder for emergency access.

Set: 2.0
Doors: C100B
Description: Ext - Alum - Pair - Rim/EO x KRM -HD Par SP Closer

6	Hinge	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK
1	Removable Mullion	L980S / L980A	PC	SA
2	Exit Device (exit only)	8810	US32D	SA

2	Cylinder	980C1	US26D	SA		
2	Door Closer	CPS7500	689	NO		
1	Threshold	252x3AFG	MSES25SS			PE
2	Sweep	315CN		PE		

Notes:
Perimeter and meeting stile gasket by door / frame manufacturer.

Set: 3.0
Doors: C113D
Description: Ext - Alum - Sgl - Push/Pull - Deadlock - HD SP Closer

6	Hinge	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK		
2	Flush Bolt	555	US26D	RO		
1	Mortise Deadlock	MS1850SN Schoolhouse Function			628	AD
1	Cylinder	DG1 63 41	US32D	SA		
1	Cylinder Thumb Turn	4066-01	130	AD		
2	Push Bar & Pull	BF15747 Mtg-Type 5		US32D	RO	
2	Door Closer	CPS7500	689	NO		
1	Threshold	252x3AFG	MSES25SS			PE
2	Sweep	315CN		PE		

Notes:
Perimeter and meeting stile gasket by door / frame manufacturer.

Set: 4.0
Doors: C102
Description: Ext - Alum - Sgl - Push/Pull - Deadlock - HD SP Closer

3	Hinge	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK		
1	Mortise Deadlock	MS1850SN Schoolhouse Function			628	AD
1	Cylinder	DG1 63 41	US32D	SA		
1	Cylinder Thumb Turn	4066-01	130	AD		
1	Push Bar & Pull	BF15747 Mtg-Type 5		US32D	RO	
1	Door Closer	CPS7500	689	NO		
1	Threshold	252x3AFG	MSES25SS			PE
1	Sweep	315CN		PE		

Notes:
Perimeter and meeting stile gasket by door / frame manufacturer.

Set: 5.0
Doors: C111, C115A
Description: Ext - Sgl - FSE Lock - Card Reader - HD SP Closer

3	Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK		
1	Fail Secure Lock	DG1 RX 63 10G71- LL		US26D	SA	
1	Door Closer	CPS7500	689	NO		
1	Threshold	253x3AFG	MSES25SS			PE
1	Rain Guard	346C		PE		
1	Sweep	315CN		PE		
1	Electric Power Transfer	CEPT-10		SU		
1	ElectroLynx Harness	QC-C1500P			MK	
1	Card Reader	By Security Supplier				
1	ElectroLynx Harness	QC-C****		MK		
1	Door Position Switch	DPS2 - M / W-BK			SU	
1	Card Reader	By security provider			OT	

1	Power Supply	EPS-05	SU

Notes:
Hollow metal frame manufacturer to provide weather stripping in the Thermal Break frame.

System Operational Narrative:
- Doors normally closed and secure.
- Access by valid credential presentation retracting latches for a pre-determined time limit and then relocking.
- Egress always free for immediate exit. Request-to-Exit sensors allows exit without alarm condition.
- Door position switches provide open/closed monitoring to both access control system and intrusion alarm service.
- Latches remain projected/locked (fail secure) in event of power loss. Key override cylinder for emergency access.

Set: 6.0
Doors: C103, C104
Description: Ext - Sgl - Storeroom - HD SP Closer

3	Hinge	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK	
1	Storeroom Lock	DG1 63 10G04 LL	US26D	SA	
1	Door Closer	CPS7500689	NO		
1	Threshold	253x3AFG MSES25SS			PE
1	Rain Guard	346C	PE		
1	Sweep	315CN	PE		

Notes:
Hollow metal frame manufacturer to provide weather stripping in the Thermal Break frame.

Set: 7.0
Doors: M102
Description: Pair - Rim/nl x Rim/dt x ELR - KRM- HD Par SP Closers

6	Hinge	TA2714	US26D	MK		
1	Removable Mullion	L980S / L980A	PC	SA		
1	Rim Exit Device (elr - night latch)		55 56 8804		US32D	SA
1	Rim Exit Device (elr - exit only)		55 56 8810		US32D	SA
1	Cylinder	980C1	US26D	SA		
2	Pull	RM201 Mtg-Type 1XHD	US32D	RO		
2	Door Closer	CPS7500689	NO			
2	Kick Plate	K1050 10" high BEV CSK	US32D	RO		
2	Harness Adaptor	52-2946	SA			
2	ElectroLynx Harness	QC-C1500P			MK	
1	Card Reader	By Security Supplier				
2	ElectroLynx Harness	QC-C****	MK			
2	Door Position Switch	DPS2 - M / W-BK			SU	
1	Power Supply	AQD6	SU			

Notes:
System Operational Narrative:
- Doors normally closed and secure.
- Access by valid credential presentation retracting latches for a pre-determined time limit and then relocking.
- Egress always free for immediate exit. Request-to-Exit sensors allows exit without alarm condition.
- Door position switches provide open/closed monitoring to both access control system and intrusion alarm service.
- Latches remain projected/locked (fail secure) in event of power loss. Key override cylinder for emergency access.

Set: 8.0

Doors: E201 Alt6, H104, H105
Description: Pair - Rim/nl x Rim/dt x ELR - KRM- HD Par SP Closers

6	Hinge	TA2714	US26D	MK		
1	Removable Mullion	CR907BKM 7' 6P		RU		
1	Exit Device (nightlatch)	ED5200 K157ET x 6P M92 MELR			630	RU
1	Exit Device (exit only)	ED5200 EO M92 MELR			630	RU
2	Pull	RM201 Mtg-Type 1XHD		US32D	RO	
2	Door Closer	CPS7500 689		NO		
2	Kick Plate	K1050 10" high BEV CSK		US32D	RO	
2	Harness Adaptor	52-2946		SA		
2	ElectroLynx Harness	QC-C1500P			MK	
1	Card Reader	By Security Supplier				
2	ElectroLynx Harness	QC-C****		MK		
2	Door Position Switch	DPS2 - M / W-BK			SU	
1	Power Supply	784		RU		

Notes:
System Operational Narrative:
- Doors normally closed and secure.
- Access by valid credential presentation retracting latches for a pre-determined time limit and then relocking.
- Egress always free for immediate exit. Request-to-Exit sensors allows exit without alarm condition.
- Door position switches provide open/closed monitoring to both access control system and intrusion alarm service.
- Latches remain projected/locked (fail secure) in event of power loss. Key override cylinder for emergency access.

Set: 9.0
Doors: E202
Description: Pair - Rim/nl x Rim/dt x ELR - KRM- HD Par Closers - MHO

6	Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"			US26D	MK
1	Removable Mullion	CR907BKM 7' 6P		RU		
1	Exit Device (nightlatch)	ED5200 K157ET x 6P M92 MELR			630	RU
1	Exit Device (exit only)	ED5200 EO M92 MELR			630	RU
2	Pull	RM201 Mtg-Type 1XHD		US32D	RO	
2	Door Closer	7500	689	NO		
2	Kick Plate	K1050 10" high BEV CSK		US32D	RO	
2	Electromagnetic Holder	998M x Voltage		689	RF	
2	Harness Adaptor	52-2946		SA		
2	ElectroLynx Harness	QC-C1500P			MK	
1	Card Reader	By Security Supplier				
2	ElectroLynx Harness	QC-C****		MK		
2	Door Position Switch	DPS2 - M / W-BK			SU	
1	Power Supply	784		RU		

Notes:
System Operational Narrative:
- Doors normally closed and secure.
- Access by valid credential presentation retracting latches for a pre-determined time limit and then relocking.
- Egress always free for immediate exit. Request-to-Exit sensors allows exit without alarm condition.
- Door position switches provide open/closed monitoring to both access control system and intrusion alarm service.
- Latches remain projected/locked (fail secure) in event of power loss. Key override cylinder for emergency access.

Set: 10.0
Doors: E118
Description: Pair - Storeroom - AFB - Closer/stop

6	Hinge	TA2714 4-1/2" x 4-1/2"		US26D	MK
1	Automatic Flush Bolt	2842/2942		US26D	RO

1	Dust Proof Strike	570	US26D	RO	
1	Storeroom Lock	CL3357 NZD		626	RU
1	Coordinator	2672	US28	RO	
2	Mounting Bracket	2601AB or 2601C		Black	RO
2	Door Closer	CLP7500 689		NO	
1	Gasketing	S88D.		PE	
1	Astragal S771D		PE		
1	Astragal 3572SP		PE		

Set: 11.0
Doors: C105
Description: Sgl - Storeroom, - Closer

3	Hinge TA2714	4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	DG1 63 10G04 LL	US26D	SA
1	Door Closer	7500 689	NO	
1	W/F Stop 406 / 441CU		US26D	RO
1	Gasketing	S88D.		PE

Set: 12.0
Doors: C101A, C113A
Description: Sgle - Classroom Lock - W/F Stop

3	Hinge TA2714	US26D	MK	
1	Classroom Lock	DG1 63 10G37 LL	US26D	SA
1	Wall Stop 403 / 441CU	(As Req'd)	US26D	RO
3	Silencer - Metal Frame	608		RO

Set: 13.0
Doors: E104, E105, E106, E107, E108, E109, E110, E111, E112, E113, E114, E117, E121
Description: Sgle - Classroom Lock - W/F Stop

3	Hinge TA2714	US26D	MK	
1	Classroom Lock	CL3355 NZD	626	RU
1	Wall Stop 403 / 441CU	(As Req'd)	US26D	RO
3	Silencer - Metal Frame	608		RO

Set: 14.0
Doors: E116
Description: Sgle - Rated - Privacy - Reg/ PA Closer - W/F Stop

3	Hinge TA2714	US26D	MK	
1	Privacy Lock	CL3320 NZD	626	RU
1	Door Closer	7500 689	NO	
1	Gasketing	S88D.	PE	

Set: 15.0
Doors: C107, C108
Description: Sgle - Rated - Privacy - HD Par Stop Closer - W/F Stop

3	Hinge TA2714	US26D	MK	
1	Privacy Lock	10U65 LL	US26D	SA
1	Door Closer	CLP7500 689	NO	
1	Gasketing	S88D.	PE	

Set: 16.0
Doors: E122
Description: Sgl - Storage - OH Stop

3	Hinge	TA2714 4-1/2" x 4-1/2"		US26D	MK
1	Storeroom Lock	CL3357 NZD		626	RU
1	Surf Overhead Stop		55-X36	652	RF
3	Silencer - Metal Frame		608		RO

Set: 17.0
Doors: C112
Description: Office Sgl - Office

3	Hinge	TA2714 4-1/2" x 4-1/2"		US26D	MK
1	Office Lock	DG1 63 10G05 LL		US26D	SA
1	W/F Stop 406 / 441CU		US26D	RO	
1	Silencer - Metal Frame		608		RO

Set: 18.0
Doors: C101B, C110
Description: Sgl - Classroom

3	Hinge	TA2714 4-1/2" x 4-1/2"		US26D	MK
1	Classroom Lock	DG1 63 10G37 LL		US26D	SA
1	W/F Stop 406 / 441CU		US26D	RO	
3	Silencer - Metal Frame		608		RO

Set: 19.0
Doors: C106, C107
Description: Sgl - Passage - W/F Stop

3	Hinge	TA2714 4-1/2" x 4-1/2"		US26D	MK
1	Passage Set	10U15 LL		US26D	SA
1	W/F Stop 406 / 441CU		US26D	RO	
3	Silencer - Metal Frame		608		RO

Set: 20.0
Doors: E115
Description: Sgl - Privacy - OH Stop

3	Hinge	TA2714 4-1/2" x 4-1/2"		US26D	MK
1	Privacy Lock	CL3320 NZD		626	RU
1	Surf Overhead Stop		55-X36	652	RF
1	Gasketing	S88D.		PE	

Set: 21.0
Doors: C113B, C113C
Description: Sgl - Dbl Acting - Push/Pull - OH Conc Closer

2	Push Plate	70F	US32D	RO	
1	Concealed Closer	MW608 90A		626	RF
2	Kick Plate	K1050 10" 4BE CSK		US32D	RO

Set: 22.0
Doors: M101
Description: Existing Rated Sgl - Add Mag Lock

1	Magnetic Lock	M680EBDX	628	SU	
1	Card Reader	By security provider			OT
1	Push Button	EEB2	SU		
1	Power Supply	AQD2	SU		

Notes:
Leave existing lock unlocked. The new mag locks will secure the opening.

Card Reader, wiring and connections by security provider.

Set: 23.0
Doors: E203
Description: Existing RatedDbl Egress Pair - Add Mag Lock

2	Magnetic Lock	M680EBDX	628	SU	
2	Card Reader	By security provider			OT
1	Push Button	EEB2	SU		
1	Power Supply	AQD6	SU		

Notes:
The new mag locks will be activated by the "Lockdown" procedure.

Card Reader, wiring and connections by security provider.

Set: 24.0
Doors: H115, H119
Description: Ext Pair - Audible Alarm - Door Contact

1	Timer	TM-9	SU	
1	Alarm	PZ1	SU	
2	Position Switch	MSS-1	SU	

Notes:
Timer is set for a 30 second signal delay from the DPS to the Alarm.

Alarm will sound if door is propped open for more than 30 seconds.

Set: 25.0
Doors: E205, E207, H112, H117, H118, M108
Description: Ext Sgl - Existing Rim Exit Device - New Electric Strike

1	Electric Strike	9500-LBM	630	HS	
1	Card Reader	By security provider			OT
1	Power Supply	EPS-05	SU		

Notes:
Card Reader, wiring and connections by security provider.

Set: 26.0
Doors: E200, E204, E206, E208, E209, E210, E211, E212, E213, E214, H100, H101, H106, H107, H108, H109, H110, H111, H113, H114, H116, M100, M103, M104, M105, M106, M107, M109, M110, M111, M114, M115
Description: Ext Pair - Existing Rim Exit Device - New Electric Strike

2	Electric Strike	9500-LBM	630	HS	
1	Card Reader	By security provider			OT
1	Power Supply	EPS-05	SU		

Notes:
Card Reader, wiring and connections by security provider.

Set: 27.0
Doors: M112, M113

Description: Ext Sgl - Replace existing lock - FSE Lock

1	Fail Secure Lock	DG1 RX 63 10G71- LL		US26D	SA
1	Door Loop	TSB-CXL	SU		
1	Card Reader	By security provider			OT
1	Power Supply	EPS-05	SU		

Notes:
Card Reader, wiring and connections by security provider.

Security contractor to provide a surface junction box on the inside wall for the power.

The door loop is to span the junction box to the face of the door on the hinge side to run the power through the door to the new electric lock.

Set: 28.0
Doors: H103
Description: Ext Sgl - Replace existing lock - FSE Lock

1	Fail Secure Lock	CL33905 NZD M92 626		RU	
1	Door Loop	TSB-CXL	SU		
1	Card Reader	By security provider			OT
1	Power Supply	EPS-05	SU		

Notes:
Card Reader, wiring and connections by security provider.

Security contractor to provide a surface junction box on the inside wall for the power.

The door loop is to span the junction box to the face of the door on the hinge side to run the power through the door to the new electric lock.

Set: 29.0
Doors: E201, H102
Description: Existing Pair - Add Mag Lock

2	Magnetic Lock	M680EBDX	628	SU	
1	Card Reader	By security provider			OT
1	Push Button	EEB2	SU		
1	Power Supply	AQD6	SU		

Notes:
Card Reader, wiring and connections by security provider.

Set: 30.0
Doors: C115B
Description: All Hardware by Dr provider

1	All Hardware by door manufacturer.	00

08 80 00 - GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION: Furnish all labor, materials, tools, & equipment as required for all Glazing work, as shown on the Drawings, specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section. The requirements of other sections may affect the work under this section. In addition, comply with pertinent recommendations contained in the Flat Glass Marketing Association "Glazing Sealing Systems Manual" & "Glazing Manual."

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

1.4 STORAGE: During storage and handling of glass, provide cushions at edges to prevent impact damage.

1.5 Submittals:

A. Product Data: Submit manufacturer's product data.

B. Product Samples: Submit samples to Architect illustrating color and tint options for selection.

PART 2 - PRODUCTS

2.1 GENERAL: For all glass, provide the type and thickness shown on the Drawings or specified herein. Where type or thickness, or both, are not shown on the Drawings or specified herein, provide type and thickness directed by the Architect. Provide clear interior glazing and tinted exterior glazing unless indicated otherwise.

2.2 GLASS: Plate or float glass to comply with Fed Spec DD-D-451, type I, Class I, quality q3.2. Sheet glass to be type II, class 1, quality q5. Provide tempered or heat-strengthened glass where indicated or as required by governmental agencies having jurisdiction.

2.3 EXTERIOR GLAZING:

A. 1" Insulated Low-E Tinted glazing thermally broken frames
B. U-Value 0.27
C. Visible Light Transmittance 54%
D. Solar heat gain coefficient 0.27
E. Shading coefficient 0.31
F. Outdoor Visible Light Reflectance 8%.
G. Color as approved by architect.

2.4 INTERIOR GLAZING: All interior glazing to be ¼" minimum. Provide safety or rated glass as required by code or as shown.

2.5 SAFETY GLASS: All glazing in doors, adjacent to doors, below 60" AFF & as shown, to be tempered or laminated safety type. All glass at gymnasiums, weight rooms and locker rooms to be safety glass.

A. Exceptions: Glazing at fire rated assemblies

2.6 MIRRORS: 1/4" plate glass mirrors with ground edges, in sizes indicated, complete with all attachment hardware.

2.7 GLAZING IN FIRE RATED ASSEMBLIES: Fireglass 20; meet all code requirements.

2.8 FROSTED GLASS: Provide translucent window film on glass at locations indicated.

2.9 OTHER MATERIALS: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine & prepare areas and conditions under which work of this Section will be performed. Do not proceed until unsatisfactory conditions are corrected. Clean glazing channels, stops, and rabbets to receive the glazing materials, making free from obstructions and deleterious substances which might impair the work. Remove protective coatings which might fail in adhesion or interfere with bond of sealants. Comply with manufacturer's instructions for final wiping of surfaces immediately prior to application of primer and glazing compounds or tapes. Prime surfaces to receive glazing compounds in accordance with manufacturer's recommendations.

3.2 INSTALLATION: Do not install items which are improperly sized, have damaged edges, or are scratched, or damaged in any other manner. Do not remove labels from glass until so directed by the Architect. Install glass so distortion waves are consistent with existing. Use blocks of proper size & spacing to support the glass in accordance with the manufacturer's recommendations. Make bite of spacer on glass 1/4" or more. Set glass in a manner which produces the greatest possible degree of uniformity in appearance. Do not use two different glazing materials in the same joint system unless the joint use is approved in advance by the Architect. Mask, or otherwise protect, surfaces adjacent to installation of sealants.

3.3 PROTECTION: Protect glass from breakage after installation by promptly installing streamers or ribbons, suitably attached to the framing and held free form glass. Do not apply warning markings, streamers, ribbons, or other items directly to the glass except as specifically directed by the Architect.

08 83 00 - MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes annealed monolithic glass mirrors.

1.2 SUBMITTALS

A. Product Data: For mirror hardware and mastic.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachments to other work.

C. Samples: For each type of mirror product required, in the form indicated below:

1. Mirrors, 12 inches square, including edge treatment on 2 adjoining edges.

2. Mirror clips.

3. Mirror trim, 12 inches long.

1.3 QUALITY ASSURANCE

A. Glazing Publications: Comply with GANA's “Glazing Manual” and GANA Mirror Division's “Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors” unless more stringent requirements are indicated

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors, protected from moisture including condensation.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form, made out to Owner and signed by mirror manufacturer agreeing to replace mirrors that deteriorate, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated in second subparagraph below.

B. Deterioration of Mirrors: Defects developed from normal use that are attributable to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning mirrors contrary to mirror manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

C. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRROR MATERIALS

A. Clear Glass Mirrors: ASTM C 1503, Mirror Select Quality.

1. Nominal Thickness: 6.0 mm.

2.2 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Type A Shore durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

2.3 MIRROR HARDWARE

A. Top and Bottom Aluminum J-Channels: Aluminum extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.

1. Bottom Trim: J-channels formed with front leg and back leg not less than 5/16 and 3/4 inch in height, respectively.

2. Top Trim: Formed with front leg with a height of 5/16 inch and back leg designed to fit into the pocket created by wall-mounted aluminum cleat.

3. Product: Subject to compliance with requirements, provide the following:

a. Bottom Trim: C. R. Laurence Co., Inc.; D638 FHA Type ”J” Channel.

b. Top Trim: C. R. Laurence Co., Inc.; D 1638 Top Channel.

c. Cleat: C. R. Laurence Co., Inc.; D 1637M Mirror Mount System Cleat.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors.

D. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

A. Mirror Sizes: To suit Project conditions, cut mirrors to final sizes and shapes.

B. Cutouts: Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size Cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished edge.

1. Seal edges of mirrors after edge treatment to prevent chemical or atmospheric penetration of glass coating.

2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

B. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. For wall-mounted mirrors, install with mastic and mirror hardware.

1. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

2. For mirror hardware in the form of a continuous J-channel at bottom and continuous top trim at top, fasten J-channel directly to wall and attach top trim to continuous cleat fastened directly to wall.

3. Install mastic as follows:

a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.

4. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

5. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.

D. Protect mirrors from breakage and contaminating substances resulting from construction operations.

E. Do not permit edges of mirrors to be exposed to standing water.

F. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

08 88 13 - FIRE-RESISTANT GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-rated glazing materials installed as vision lights in fire-rated doors.

2. Fire-rated glazing materials installed in fire-rated frames and 2-HOUR wall applications.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E 119: Fire Tests of Building Construction and Materials.

2. ASTM E2074-00: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.

3. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.

B. American National Standards Institute (ANSI):

1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

C. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials

D. Glass Association of North America (GANA):

1. GANA – Glazing Manual.

2. FGMA – Sealant Manual.

E. National Fire Protection Association (NFPA):

1. NFPA 80: Fire Doors and Windows.

F. Underwriters Laboratories, Inc. (UL):

1. UL 263: Fire tests of Building Construction and Materials

1.3 PERFORMANCE REQUIREMENTS

A. Fire-rated, clear and wireless glazing material for use in locations such as doors, sidelites, transoms, borrowed lites, and wall applications with fire rating requirements ranging from 45 minutes to 2 hours with hose stream test; for use in interior and exterior applications.

B. Provides protection by reducing the radiant and conductive heat transfer

1.4 SUBMITTALS

A. Note: Specify submittal requirements for fire-rated doors and fire-rated frames, including glass stops in the appropriate Sections.

B. Comply with specified requirements.

C. Product data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.

D. Certificates of compliance from glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements. Separate certification will not be required for glazing materials bearing manufacturer's permanent label designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authority having jurisdiction.

E. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.

F. Samples: Submit, for verification purposes, approx. 8-inch by 10-inch sample for each type of glass indicated.

1.5 QUALITY ASSURANCE

A. Glazing Standards: FGMA Glazing Manual and Sealant Manual.

B. Fire Resistance Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire resistive assemblies.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to specified destination in manufacturer's or distributor's packaging, undamaged, complete with installation instructions.

B. Do not expose Pyrostop to temperatures greater than 120 degrees or less than minimum 40 degrees F during storage and transportation.

C. Store off ground, under cover, protected from weather and construction activities.

D. Do not expose the non-PVB side of glass to UV light.

E. Store sheets of glass vertically. DO NOT lean.

1.7 WARRANTY

A. Warranty period: Five years from date of shipment by manufacturer.

PART 2 - PRODUCTS

2.1 FIRE-RATED GLAZING MATERIALS

A. Manufacturer: Pyrostop™ as manufactured by the Pilkington Group and distributed by Technical Glass Products, Kirkland, Washington, voice 1-800-426-0279, fax 1-800-451-9857, e-mail sales@fireglass.com, web site www.fireglass.com.

B. Composition: Composed of multiple sheets of "Optiwhite" high visible light transmission glass laminated with an intumescent interlayer.

C. Properties:

1. Thickness: For Interior Use: [3/4", #45-200], [15/16", #60-101], [1-7/16, #90-102], [2-1/8", #120-204].

2. For Exterior Use, Single Glazing: [3/4", #45-200], [1 1/16", #60-201], [1 9/16", #120-202].

3. For Exterior Use, Insulated Glass Unit: [1 5/16", #45-250], [1 5/8", #60-251], [1 9/16", #120-202], [2 1/8", #120-262]

4. Weight: Varies with thickness (approximate range 9 to 22 lbs./sq. ft.).

5. Approximate Visible Transmission: Varies with thickness (approximate range 88 to 75 percent).

6. Fire-rating: Up to 2 hours.

7. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).

8. STC Rating: Up to 46 Db

D. Permanently label each piece of Pyrostop with the appropriate marking.

E. Fire Rating – 60 Minutes and Greater: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E 119 and UL 263.

2.2 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

A. Glazing Tape: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to affect an air and vapor seal.

B. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:

1. Dow Corning 795 - Dow Corning Corp.

2. Silglaze-II 2800 - General Electric Co.

3. Spectrem 2 - Tremco Inc.

C. Setting Blocks: Hardwood or calcium silicate; glass width by 4 inches by 3/16 inch thick.

D. Spacers: Neoprene or other resilient blocks of 40 to 50 Shore A durometer hardness, adhesive-backed on one face only, tested for compatibility with specified glazing compound.

E. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.

2.3 FABRICATION

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with the following:

B. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.

C. Minimum required face or edge clearances.

D. Observable edge damage or face imperfections.

E. Do not proceed with glazing until unsatisfactory conditions have been corrected.

F. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.2 INSTALLATION (GLAZING)

A. Comply with referenced GANA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.

B. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.

C. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.

D. Place setting blocks located at quarter points of glass with edge block no more than 6-inches from corners.

E. Glaze vertically into labeled fire-rated metal frames or partition walls with same fire rating as glass and push against tape for full contact at perimeter of pane or unit.

F. Place glazing tape on free perimeter of glazing in same manner described above.

G. Do not remove protective edge tape.

H. Install removable stop and secure without displacement of tape.

I. Do not pressure glaze.

J. Glaze exterior openings with PVB layer toward the exterior of the building.

K. Knife trim protruding tape.

L. Apply cap bead of silicone sealant along void between the stop and the glazing, to uniform line, with bevel to form watershed away from glass. Tool or wipe sealant surface smooth.

M. Provide minimum 3/16 inch edge clearance.

N. Install in vision panels in fire-rated doors to requirements of NFPA 80.

O. Install so that appropriate UL & Pyrostop markings remain permanently visible.

3.3 PROTECTION AND CLEANING

A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.

B. Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

08 88 55 – DECORATIVE INFILL PANELS

PART 1 - GENERAL

1.1 SCOPE

A. Requirements of the general conditions and special conditions apply to the work in this section.

B. Provide all labor, materials, etc. necessary for the completion of the work of this section as specified or shown on the drawings.

C. Work of this section consists of, but is not limited to the following:

1. Exterior, insulated, weather resistant decorative infill panels. To be located at exterior storefront conditions as a decorative accent.

2. Interior decorative infill panels. To be located at interior storefront conditions as a decorative accent.

1.2 SUBMITTALS

A. Comply with requirements of Section regarding submittals.

B. Manufacturer's Data

1. Provide required number copies of:

a. Product data sheets.

b. Installation instructions.

c. Replacement parts information.

C. Shop Drawings

1. Provide required number of copies of all shop drawings.

2. Show fabrication and erection of compartment assemblies, to extent not fully described by manufacturer's data sheets.

3. Show anchorage, accessory items and finishes.

4. Provide location drawings for bolt hole locations in supporting members for attachment of compartments.

D. Samples

1. Furnish scale model of compartments, including stile, shoe, door, door hardware, divider panel, and mounting brackets.

2. Furnish sections showing stile anchoring and leveling devices, concealed threaded inserts, panel and stile construction and edge construction.

PART 2 - PRODUCTS

2.1 EXTERIOR DECORATIVE INFILL PANELS

A. 1” Omega Foam-Ply by Laminators Inc., or equal as approved by Architect, with designer series, natural series or Kynar 500 finish, as selected by Architect, both sides.

B. Finish width to be 1”.

2.2 INTERIOR DECORATIVE INFILL PANELS

A. Solid phenolic material constructed of solidly fused plastic laminate with matte finish melamine surfaces, patterned face sheets, and black phenolic-resin core that are integrally bonded.

1. Approved product: Compact Laminate Product Type 569 by Wilsonart

B. Finish width to be ¼”.

C. Plastic Laminate face finish to match material provided in 06 41 16 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine & prepare areas and conditions under which work of this Section will be performed. Do not proceed until unsatisfactory conditions are corrected. Clean glazing channels, stops, and rabbets to receive the infill panel, making free from obstructions and deleterious substances which might impair the work. Remove protective coatings which might fail in adhesion or interfere with bond of sealants. Comply with manufacturer's instructions for final wiping of surfaces immediately prior to application of primer and glazing compounds or tapes. Prime surfaces to receive glazing compounds in accordance with manufacturer's recommendations.

3.2 INSTALLATION: Do not install items which are improperly sized, have damaged edges, or are scratched, or damaged in any other manner. Do not remove labels from panels until so directed by the Architect. Install panels so paterns are consistent with existing or as instructed by Architect. Use blocks of proper size & spacing to support the panels in accordance with the manufacturer's recommendations. Make bite of spacer on panels 1/4" or more. Set panels in a manner which produces the greatest possible degree of uniformity in appearance. Do not use two different panels in the same joint system unless the joint use is approved in advance by the Architect. Mask, or otherwise protect, surfaces adjacent to installation of sealants.

3.3 PROTECTION: Protect panels from breakage after installation by promptly installing streamers or ribbons, suitably attached to the framing and held free form panels. Do not apply warning markings, streamers, ribbons, or other items directly to the panels except as specifically directed by the Architect.

DIVISION 09 – FINISHES

09 03 66 – TERRAZZO RESTORATION & CLEANING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS: Work under this section includes cleaning and restoring terrazzo flooring and base.

1.2 QUALITY ASSURANCE: Work under this section must be performed by a firm which has a minimum five years experience restoring terrazzo flooring.

1.3 WARRANTIES: Warrant for a period of two years that restoration procedures will not harm substrate or adjacent materials including, but not limited to: Discoloration of substrate from improper product usage; Chemical damage from inadequate rinse procedures; Abrasive damage from improper procedures; Discoloration or damage to torrazzo flooring.

1.4 SUBMITTALS: Proof of experience requirements for firm doing the actual work, or designation and qualifications for the restoration contractor. Product Manufacturer's Product Literature. Description of workplan.

PART 2 - PRODUCTS

2.1 STRIPPER

A. Basis of Design: Pro Strip PURE Non-Corrosive Floor Stripper by Diversey

B. Neutral pH, between 7 to 10, when used on Portland cement binder terrazzo.

2.2 SEALER:

A. Basis of Design: Fortify® Hard Surface Floor Sealer by Diversey

B. Neutral pH, between 7 to 10.

C. Water based acrylic.

D. Slip resistance coefficient of friction rating of minimum 0.5

E. Three (3) coats

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS: Protect persons and property from injury and damage from cleaning operations.

3.2 WORK SEQUENCE:

A. Strip terrazzo flooring

B. Inspect and document surface conditions. Report any damaged areas to Architect and patch.

C. Seal terrazzo florring.

D. Finish terrazzo floring.

E. Review surface with architect.

3.3 TEST AREAS: Conduct a test on one test area of at least 9 square feet for each step, using the specified products and techniques to ensure no long-term damage is done before proceeding. Architect and contractor shall select location of test areas.

3.4 STRIPPING: • Blockade areas to be stripped. Strip terrazzo with stripper per manufacturer instructions. Hand or machine scrub thoroughly using appropriate stripping pads or stripping brush. Let floor dry completely. Grind down all coatings to provide a uniform appearance.

3.5 SEALING: • Blockade areas to be sealed. Apply three (3) coats per manufacturer's instructions. Allow recommended drying time between coats. Buff to a high sheen. Provide uniform final appearance.

3.6 PERFORMANCE: The actual work performed is to be done using the products and techniques established in the accepted test areas. Any proposed change of product usage must be submitted with the product manufacturer's recommendation, and written approval must be issued by the architect before being undertaken.

3.7 INSPECTION DOCUMENTATION: At the end of the stripping, cleaning, sealing and finishing, the work is to be inspected and documented by the contractor for the architect's consideration.

3.8 PROTECTION: Contractor shall protect the finished work from the time the restoration work is finished.

09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 DESCRIPTION: Provide Gypsum Wallboard Systems where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 NOTIFICATION FOR INSPECTION: Schedule an inspection with Architect prior to work on scope addressed in this section.

1.4 Submittals: Submit manufacturer's product data and installation instructions.

PART 2 - PRODUCTS

2.1 GYPSUM WALLBOARD: Provide gypsum wallboard complying with Fed Spec SS-L-30D, in 48" widths and in such lengths as will result in a minimum of joints. Use type III, grade X, class 1, 5/8" thick on all interior applications unless indicated otherwise.

2.2 HIGH IMPACT GYPSUM BOARD

A. Basis of Design: Gold Bond BRAND Hi-Impact® XP® Gypsum Board

B. Panel Physical Characteristics

1. Core: Fire-resistance rated gypsum core, with additives to enhance mold/mildew resistance, surface indentation resistance, impact resistance and moisture and mold resistant

2. Surface paper: Abrasion resistant, 100 percent recycled content moisture/mold/mildew resistant paper on front, back and long edges

3. Embedded fiberglass mesh

4. Long Edges: Tapered

5. Overall thickness: 5/8 inch

6. Panel complies with Type X requirements of ASTM C 1396

7. Surface Abrasion Resistance: Classification Level 3 in accordance with ASTM C 1629

8. Indentation Resistance: Classification Level 1 in accordance with ASTM C 1629.

9. Soft Body Impact Resistance: Classification Level 3 in accordance with ASTM C 1629

10. Hard Body Impact Resistance: Classification Level 3 in accordance with ASTM C 1629.

11. Mold/Mildew Resistance: 10 when tested in accordance with ASTM D 3273.

C. Usage: Locate this material at Gymnasium & Cafeteria below 12'-0" AFF; Corridors, Lobbies, Vestibules, Custodial, Maintenance, Vocational Shops, Stages, Weight Rooms and Exercise Rooms below 8'-0" AFF; and all other spaces as noted in the Room Finish Schedule. Unless specified otherwise, use Standard Gypsum Board per 2.1 above.

2.3 HIGH IMPACT MOISTURE RESISTANT GYPSUM BOARD

A. Basis of Design: Gold Bond BRAND eXP® Inteior Extreme® IR Gypsum Board

B. Panel Physical Characteristics:

1. Core: Regular gypsum core
2. Thickness: 1/2 inch
3. Long Edges: Tapered. Wrapped with coated fiberglass mat
4. Mold Resistance: 10 when tested in accordance with ASTM D 3273
5. Flexural Strength - Parallel: 80 lbs, when tested in accordance with ASTM C 473
6. Humidified Deflection: less than 1/4 inch when tested in accordance with ASTM C 473
7. Nail pull resistance: 80 lbs, when tested in accordance with ASTM C 473
8. Water Absorption: less than 5 percent when tested in accordance with ASTM C 473
9. Permeance: greater than 10 perms, when tested in accordance with ASTM E 96
10. Combustibility: Noncombustible when tested in accordance with ASTM E 136
11. Flame spread/Smoke Developed: 0/0 when tested in accordance with ASTM E 84
12. Environmental Requirements: Provide products that comply with testing and product requirements for low emitting materials

C. Usage: Locker Rooms

2.4 ACOUSTICALLY ENHANCED GYPSUM BOARD

A. Basis of Design: QuietRock ES, manufactured by Serious Energy

B. Panel Physical Characteristics.

1. Thickness: 5/8 inch (15.9 mm).
2. Tolerance: +/- 0.050” on thickness.
3. Weight: 2.6 lbs/sqft.
4. Materials: Paper faced gypsum, sound damping viscoelastic polymer core.
5. STC Rating: 51-60 (ASTM E90)
6. Fire-rated: 1 hour (ASTM E119)
7. Surface flame: Class A (ASTM E84)

C. Performance Criteria: Wall Assembly STC 55 unless noted higher in drawings.

D. Accessories

1. Acoustical Sealant: QuietSeal Pro: Standard Specification for Latex Sealants (ASTM C834): Grade -18°C

a. Extrudability (ASTM C1183 Method B): ≥2.1 g/s Extrusion Rate

b. Artificial Weathering (ASTM C732 500 Hours): No wash-out, slump, or cracking. Also ≤25% total bond area loss.

c. Volume Shrinkage (ASTM C1241 Type OP): ≤30% volume shrinkage.

d. Low Temperature Flexibility (ASTM C734): No adhesion loss or cracking through to substrate after 500 hours.

e. Recovery and Adhesion Loss (ASTM C736): ≥75% recovery and ≤25% total bond area loss.

f. Slump (ASTM D2202): No slump observed.

g. Stain Index (ASTM D2203): Maximum allowable stain index of 1.

h. Surface Burning Characteristics (ASTM E84): Meets NFPA Class A Fire-Rating

2. QuietPutty: Physical Characteristics:

a. Color: Blue/Green

b. Thickness: 1/8"

c. Weight: 6 oz/pad

d. Size: 7 x 7 in/pad

e. Density: 1oz/in3

f. Unit size: 10 pads/box

g. STC-rated: 47–63 (ASTM E90)

2.5 METAL TRIM: Form from zinc-coated steel not lighter then 26 gage, complying with Fed spec QQ-S-775, type I, class d or e. Casing beads to be channel-shapes with an exposed wing, and with a concealed wing not less then 7/8" wide. Corner beads to be angle shapes with wings not less than 7/8" wide and not perforated for nailing and joint treatment, or with combination metal and paper wings bonded together, not less than 1-1/4" wide and suitable for joint treatment. Expansion joint to be pre-taped & have wings not less than 7/8" wide.

2.6 JOINTING SYSTEM: Provide a jointing system, including reinforcing tape and compound, designed as a system to be used together and as recommended for this use by the manufacturer of the gypsum wallboard approved for use on this Work. Jointing compound may be used for finishing if so recommended by its manufacturer.

2.7 FASTENING DEVICES: For fastening gypsum wallboard in place on metal studs and metal channels, use flat-head screws, shouldered, specially designed for use with power-driven tools, not less than 1" long, with self-tapping threads and self drilling points. For fastening gypsum wallboard in place on wood, use 1-1/4" type W bugle-head screws, or use annular ring type nails complying with ASTM C514 and of the length required by governmental agencies having jurisdiction.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION: Install the gypsum wallboard with the separate boards in moderate contact but not forced into place. At internal and external corners, conceal the cut edges of the boards by the overlapping covered edges of the abutting boards. Stagger the boards so that corners of any four boards will not meet at a common point except in vertical corners. Install the gypsum wallboard with the long dimension of the wallboard at right angles to the supporting members. Make end joints, where required, over framing or furring members.

3.3 ATTACHING: Drive the specified screws with clutch-controlled power screwdrivers, spacing the screws 12" on centers at ceilings and 16" on centers at walls. Where framing members are spaced 24" apart on walls, space screws 12" on centers. Attach double layers in accordance with the pertinent codes and the manufacturer's recommendations as approved by the Architect. Attach to wood as required by governmental agencies having jurisdiction.

3.4 JOINT TREATMENT: Inspect areas to be joint treated, verifying that the gypsum wallboard fits snugly against supporting framework. In areas where joint treatment and compound finishing will be performed, maintain a temperature of not less than 55 degrees for 24 hours prior to commencing the treatment, and until joint and finishing compounds have tried. Apply the joint treatment and finishing compound by machine or hand tool. Provide a minimum drying time of 24 hours between coats, with additional drying time in poorly ventilated areas.

3.5 EMBEDDING COMPOUNDS: Apply to gypsum wallboard joints and fastener heads in a thin uniform layer. Spread the compound not less than 3" wide at joints, center the reinforcing tape in the joint, and embed the tape in the compound. Then spread a thin layer of compound over the tape. After this treatment has dried, apply a second coat of embedding compound to joints and fastener heads, spreading in a thin uniform coat to not less than 6" wide at joints, and feather edged. Sandpaper between coats as required. When thoroughly dry, sandbag to eliminate ridges and high points.

3.6 FINISHING COMPOUNDS: After embedding compound is thoroughly dry and has been completely sanded, apply a coat of finishing compound to joints, fastener heads and as required to produce a uniformly smooth surface. Feather the finishing compound to not less than 12" wide. When thoroughly dry, sandpaper to obtain a uniformly smooth surface, taking care not do not scuff the paper surface of the wallboard, to meet ASTM C 840 Level 5 Finish.

3.7 CORNER TREATMENT: At external corners, install the specified corner bead, fitting neatly over the corner and securing with the same type fasteners used for installing the wallboard. Space the fasteners approximately 6" on centers, and drive through the wallboard into the framing or furring member. After the corner bead has been secured into position, treat the corner with joint compound and reinforcing tape as specified for joints, feathering the joint compound out form 8" to 10" on each side of the corner. At internal corners, treat as specified for joints, except fold the reinforcing tape lengthwise through the middle and fit neatly into the corner.

3.8 EXPANSION JOINTS: In addition to those shown, locate at a minimum as follows: Place vertically at the strike side of each corridor door head, on both sides of wall. Place vertically at the side of each window. Place otherwise as required to have no unjointed section of wall greater than 24'.

3.9 ACOUSTICALLY ENHANCED GYPSUM BOARD INSTALLATION

A. Install gypsum board in accordance with GA-201, GA-216, GA-600, ASTM E-90, and manufacturer's instructions.

B. Install in accordance with reference standards and manufacturer's instructions, product technical bulletins, product catalog and product carton instructions for installation [and as required to comply with seismic requirements].

C. Install framing to comply with ASTM C840 requirements that apply to framing installation.

3.10 OTHER METAL TRIM: The Drawings do not purport to show all locations and requirements for metal trim. Carefully study the Drawings and the installations, and provide all metal trim normally recommended by the manufacturer of the gypsum wallboard approved for use of this Work.

3.11 CLEANING UP: In addition to other requirements for cleaning, use necessary care to prevent scattering gypsum wallboard scraps and dust, and to prevent tracking gypsum and joint finishing compound onto floor surfaces. At completion of each segment of installation in a room or space, promptly pick up and remove from the working area all scraps, debris, and surplus material of this Section.

09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).

2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

C. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.

1. Depth: 2-1/2 inches.

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.

2. Steel Studs: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.0179 inch.

b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base Metal Thickness: 0.0179 inch.

4. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical or hat shaped.

F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.

b. Chicago Metallic Corporation; 640-C or 660-C Drywall Furring System.

c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0179 inch.

B. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.

2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.

3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

i Steel Network Inc. (The); VertiTrack VTD Series.

ii Superior Metal Trim; Superior Flex Track System (SFT).

C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.0179 inch.

D. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.

2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.

E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 0.0179 inch.

2. Depth: As indicated on Drawings.

F. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

G. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.

2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare-steel thickness of 0.0312 inch.

3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.

2.4 AUXILIARY MATERIALS

A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Foam Gasket Isolation Strip at Exterior Walls: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

3.2 INSTALLING SUSPENSION SYSTEMS

A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

B. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Do not attach hangers to steel roof deck.

4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

C. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb, unless otherwise indicated.

b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

5. Curved Partitions:

   a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.

   b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

C. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

09 29 62 - WATER RESISTANT GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION: Work in this section includes, but is not limited to wall, ceiling and soffit sheathing. Specific applications include:

A. Exterior sheathing at all stud backup walls.

B. Wallboard at all showers & toilet rooms.

C. Ceilings at all showers.

D. Bottom 3" at all drywall partitions.

E. Exterior soffits at drywall construction indicated.

F. As a backer board behind ceramic tile.

G. Wallboard behind fiberglass wall panels.

H. As noted elsewhere.

1.2 SUBMITTALS: Submit manufacturer's descriptive literature indicating material composition, thickness, sizes and fire resistance. Submit manufacturer's written certification that product meets specified requirements.

1.3 QUALITY ASSURANCE: Where applicable, provide materials and construction that are identical to those of assemblies whose fire-resistance ratings are indicated.

1.4 DELIVERY, STORAGE AND HANDLING: Deliver materials to the job site in manufacturer's original packaging, containers and bundles with manufacturer's brand name and identification intact and legible. Storage and handling: Store level and handle materials to protect against contact with damp and wet surfaces, exposure to weather, breakage and damage to edges. Provide air circulation under covering and around stacks of materials.

1.5 SPECIAL CONSIDERATIONS: Avoid any condition that will create moisture in the air and condensation on the exterior walls during periods when the exterior temperature is lower than the interior. Exposed wall ends such as may be found in parapets must be covered to prevent water from infiltrating the cavity. For all installations, design details such as fasteners, sealants and control joints per system specifications must be properly installed per system specifications. Openings and penetrations must be properly flashed and sealed.

1.6 WARRANTY: Provide sheathing manufacturer's standard warranty covering sheathing materials for five years commencing on date of purchase. Provide sheathing manufacturer's standard warranty covering in-place exposure damage to sheathing for six months commencing on date of purchase by contractor.

PART 2 - PRODUCTS

2.1 BOARD: Gypsum sheathing manufactured in accordance with ASTM C 1177 with glass mats both sides and long edges, water-resistant treated core; ½" or 5/8" thick by 4' by 8', 9' or 10'. Noncombustible when tested in accordance with ASTM E 136. Products include those listed at the locations indicated, equal to DensGuard products by GP Gypsum Co:

A. Densglass Gold Exterior Guard, ½" thick (exterior sheathing, ceiling board in wet areas)

B. Densglass Gold Exterior Guard, 5/8" thick (bottom 3" of drywall partitions.)

C. Densarmour Abuse Guard, 5/8" thick (high-impact conditions for walls in wet areas.)

D. Denssheild Tile Guard, 5/8" (behind ceramic tile, walls in restrooms & other wet areas.)

2.2 ACCESSORIES

A. Nails, wood framing: Hot dip, 11-gauge galvanized nails with ‡/¡§" head, 1H" min. length.

B. Screws, metal framing: Type S-12, bugle head, self-tapping, rust-resistant, fine thread for heavy-steel gauge (12 to 22). Type S, bugle head, rust-resistant sharp point, fine thread for light-gauge metal framing or furring.

C. Screws, metal or wood framing: Wafer head, rust-resistant, Type S-12 drill or Hi-Lo, min. 1" length. Or Type W rust-resistant, bugle head, coarse thread, sharp point for wood.

PART 3 - EXECUTION

3.1 PREPARATION: Examine subframing; verify that surface of framing and furring members to receive sheathing does not vary more than recommended by manufacturer.

3.2 SHEATHING: Provide exterior sheathing where indicated on drawings. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253 and ASTM C 1280. Install sheathing per manufacturer's recommendations. Use maximum lengths possible to minimize number of joints. Attach sheathing to wood framing with nails spaced 4" o.c. at perimeter for racking shear resistance; 8" o.c. at perimeter where there are framing supports and where racking shear resistance is not required; and 8" o.c. along intermediate framing in field for both conditions. Attach sheathing to metal framing with screws spaced 8" o.c. at perimeter where there are framing supports; and 8" o.c. along intermediate framing in field. Drive fasteners to bear tight against and flush with surface of sheathing. Do not countersink. If required, install building paper or equal with flashing around openings.

3.3 FINISHING: Provide mastic damp-proofing on sheathing as specified in Section 07160.

3.4 CEILINGS, SOFFITS & INTERIOR WALLS: Apply joint tape over joints and embed in setting-type joint compound specified. Skim coat surface with setting-type joint compound for smooth finish. Prime & paint as specified.

09 30 13 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY: This Section includes the following:
- A. Ceramic mosaic tile.
- B. Quarry tile.
- C. Glazed wall tile.
- D. Waterproof membrane for thin-set tile installations.

1.3 SUBMITTALS: Product Data for each type of tile, mortar, grout, and other products specified. Tile samples for initial selection submit manufacturer's color charts consisting of actual tiles or sections of tiles showing the full range of colors, textures, and patterns available for each type and composition of tile indicated. Include Samples of accessories involving color selection. Grout samples for initial selection, submit manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.

1.4 QUALITY ASSURANCE: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance. Obtain each color, grade, finish, type, composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work. Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.

1.5 DELIVERY, STORAGE, AND HANDLING: Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

1.6 PROJECT CONDITIONS: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.7 EXTRA MATERIALS: Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Furnish quantity of full-size units equal to 20 SF of amount installed, for each type, composition, color, pattern, and size indicated.

1.8 PREINSTALLATION CONFERENCE: Schedule and hold preinstallation conference minimum one week prior to beginning of work on scope addressed in this section. Coordinate scheduling of meeting with Architect so that Architect can attend meeting.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- A. Marrazzi Tile
- B. American Olean Tile
- C. Dal-Tile

2.2 PRODUCTS, GENERAL: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated. Provide tile complying with Standard Grade requirements, unless otherwise indicated. Provide materials complying with ANSI standards referenced in "Setting Materials" and "Grouting Materials" articles. Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements. Provide Architect's selections from manufacturer's full range of colors, textures, and patterns for products of type indicated.

2.3 TILE PRODUCTS

A. Floor Tile: Dal-Tile “Keystones” 2”x2” porcelain mosaics with unglazed finish. Allow for 15% selected from color group 4.

B. Wall Tile: Crossville “Argent”, 12”x12” unpolished wall tile. Allow for 15% selected from color group 4

C. Quarry Tile: Dal-Tile “Quarry Tile” 6”x6” floor tile.

2.4 WATERPROOFING FOR THIN-SET TILE INSTALLATIONS: Provide products that comply with ANSI A118.10 and the descriptions in this Article. Manufacturer's standard proprietary product consisting of 1-part liquid-applied urethane in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a 2-step process.

2.5 SETTING MATERIALS: Mixture of Dry-Mortar Mix and Latex Additive: Mixture of prepackaged dry-mortar mix and liquid-latex additive. For wall applications, provide nonsagging, latex-portland cement mortar complying with ANSI A118.4 for mortar of this type defined in Section F-2.1.2.

2.6 GROUTING MATERIALS

A. FOR USE ON WALLS ONLY - Latex-Portland Cement Grout: ANSI A118.6 for materials described in Section H-2.4, composed as follows:

1. Mixture of Dry-Grout Mix and Latex Additive: Mixture of factory-prepared, dry-grout mix and latex additive complying with the following requirements:

a. Unsanded Dry-Grout Mix: Dry-set grout complying with ANSI A118.6 for materials described in Section H-2.3, for joints 1/8 inch and narrower.

b. Sanded Dry-Grout Mix: Commercial portland cement grout complying with ANSI A118.6 for materials described in Section H-2.1, for joints 1/8 inch and wider.

c. Latex Additive: Styrene butadiene rubber.

d. Latex Additive: Acrylic resin.

B. EPOXY GROUT FOR USE ON RESTROOM & KITCHEN FLOORS

1. Epoxy Grout for Restroom Floors:

a. Basis of Design: Laticrete SpectraLOCK PRO Grout: High performance grout for use with ceramic, glass and stone tile for residential or commercial applications.

b. Water cleanability: Up to 80 minutes.

c. Initial set: 2 hours.

d. Service strength: 24 hours.

e. Shrinkage: 0.25 percent.

f. Quarry/quarry bond strength: 1,000 psi (6.9 MPa) - Failure at tile.

g. Compressive strength 3,500 psi (24 MPa) - 7 days.

h. Tensile strength 1,100 psi (7.6 MPa) - 7 days.

i. Thermal shock 510 psi (3.5 MPa).

j. Water absorption: Less than 0.50 percent.

2. Epoxy Grout for Kitchen Floors:

a. Basis of Design: Latapoxy 2000 Industrial Grout: 100 percent solids stain resistant, acid- and chemical-resistant, water cleanable.

b. Compressive Strength: 10,000 psi (69 MPa), min., in accordance with ANSI A118.5.

c. Bond Strength: 620 psi (4.3 MPa), min., in accordance with ANSI A118.5.

d. Thermal Shock Resistance: Complies with ANSI A118.3.

e. Shrinkage and Sag Resistance: Complies with ANSI A118.5.

f. Initial Set and Service Set Time: Complies with ANSI A118.5.

g. Service Rating: Passing ÅSTM C 627 cycles 1-14 (TCA "Extra Heavy").

h. Color: As selected by Architect from manufacturer's full range.

2.7 MISCELLANEOUS MATERIALS: Trowelable Underlayments and Patching Compounds - Latex-modified, portland-cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated. Tile Cleaner - A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

2.8 MIXING MORTARS AND GROUT: Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions. Add materials, water, and additives in accurate proportions. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

2.9 Aluminum Trim: Aluminum trim is to be used at all head terminations, side terminations and corners.

A. Head trim: Basis of design to be Shluter QUADEC

B. Corners: Basis of design to be Shluter QUADEC

C. Finish: Anodized aluminum

2.10 THRESHOLDS & TRANSITIONS

A. Ceramic Floor Tile to Resilient Tile or Sealed Concrete: Provide ½" tall, anodized aluminum reducer, similar to "Reducer Trim" by Blanke.

B. Ceramic Floor Tile to Carpet: Provide anodized aluminum trim, similar to "Carpet Trim" by Blanke.

C. Ceramic Floor Tile to finished Concrete or Thin Film: Provide ½" tall, 3" wide anodized aluminum transition, similar to "Drive" by Blanke.

D. Handicap Accessible Showers: Provide ½" tall bullnosed marble or Corian thresholds at the entry.

PART 3 - EXECUTION

3.1 EXAMINATION: Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile. Verify that substrates for setting tile are firm; dry; clean; free from oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION: Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush. Provide concrete substrates for tile floors installed with dry-set or latex-portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated. Use trowelable leveling and patching compounds per tile-setting material manufacturer's written instructions to fill cracks, holes, and depressions. Remove protrusions, bumps, and ridges by sanding or grinding.

3.3 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.

C. Do not install tile that is cracked, chipped or otherwise unsuitable for intended purpose.

D. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

E. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

F. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

G. Lay out tile wainscots to next full tile beyond dimensions indicated.

H. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Locate joints in tile surfaces directly above joints in concrete substrates.

2. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."

I. Grout tile to comply with the requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A108.10.

J. At showers, tubs, and where indicated, install cementitious backer units and treat joints to comply with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.4 WATERPROOFING INSTALLATION: Install waterproofing to comply with waterproofing manufacturer's written instructions to produce a waterproof membrane of uniform thickness bonded securely to substrate. Do not install tile over waterproofing until waterproofing has cured and been tested to determine that it is watertight.

3.5 FLOOR TILE INSTALLATION: Install tile to comply with requirements in the Ceramic Tile Floor Installation Schedule, including those referencing TCA installation methods and ANSI A108 series of tile installation standards. Install tile on floors with the following joint widths:

A. Ceramic Mosaic Tile: 1/16 inch.

B. Quarry Tile: 1/4 inch.

C. Back Buttering: For installations indicated, obtain 100 percent mortar coverage by complying with applicable special requirements for back buttering of tile in referenced ANSI A108 series of tile installation standards:

D. Tile floors in wet areas, including showers, tub enclosures, laundries, and swimming pools.

E. Tile floors composed of tiles 8 by 8 inches or larger.

F. Tile floors composed of rib-backed tiles.

3.6 WALL TILE INSTALLATION: Install types of tile designated for wall installations to comply with requirements in the Ceramic Tile Wall Installation Schedule, including those referencing TCA installation methods and ANSI setting-bed standards. Install tile on walls with 1/16" joint widths.

3.7 STONE TILE INSTALLATION:

A. Pattern: Do not install stones vertically. Blend the stone on the wall from several different boxes to ensure proper color and size variation. See catalog photos for recommended installation pattern.

B. Chalk Lines: Should be used by installer to ensure a straight and level pattern.

C. Vertical Joints: Should be no higher than 4" on average.

D. Drystacked: A polymer modified mortar should be used for all drystacked applications.

E. Installation Info: Download Coronado's latest installation instructions at www.coronado.com for information on mortar and installation recommendations.

3.8 CLEANING AND PROTECTING: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter. Remove latex-portland cement grout residue from tile as soon as possible. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to brick and grout manufacturer. Trap and remove coating to prevent it from clogging drains. Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

09 51 23 - ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 DESCRIPTION: Provide acoustical ceilings where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

1.4 EXTRA STOCK: Deliver to the Owner for his use in future modifications, an extra stock of approximately 100 SF of each type of acoustical material installed, packaging each type of material separately, distinctly marked, and adequately protected against deterioration.

1.5 QUALITY ASSURANCE: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.6 NOTIFICATION FOR INSPECTION: Schedule an inspection with Architect prior to work on scope addressed in this section.

PART 2 - PRODUCTS

2.1 METAL "T" GRID SYSTEM: All grid to be intermediate duty 15/16” - 2’x2’ unless noted otherwise. Provide a complete system of supporting members, anchors, wall cornices, adapters for light fixtures and grilles, and accessories of every type required for a complete suspended "T" grid system of the arrangements shown on the Drawings, in white, and complying with pertinent requirements of Underwriters Laboratories, Inc., and the governmental agencies having jurisdiction. Acceptable products:

A. Chicago Metallic Corp., "Snap Grid 500".

B. Armstrong

C. Products of other manufacturers when approved in advance by the Architect will be considered.

2.2 ACOUSTICAL CEILING PANELS: Panel size 24"x 24"x 5/8", square edge. Surface flame spread to be 25 or less, smoke developed 50 or less & be UL listed. NRC 0.55 or greater, CAC 33 or better, Light Reflectance 0.85. Acceptable products:

A. Armstrong Fine Fissured HumiGuard Plus #1728.

B. Comparable product by USG

C. Comparable product by Certain-Teed

D. Products of other manufacturers when approved in advance by the Architect will be considered.

2.3 DAMP LOCATION SYSTEM: At damp locations such as restrooms & kitchens, & as indicated in the drawings, use vinyl covered ½” gypsum panels in a stainless steel capped or aluminum grid system, rated for damp location.

2.4 FIRE RATED SYSTEM: As indicated in the drawings, provide one hour rated system assembly. Acceptable products: Chicago Metallic Corp., "Snap Grid 500; USG "Fire Front 850" grid; USG Interiors "Auratone" 5/8" Fissured Firecode panels; Celotex "Protectone". Other products determined by the Architect to be equal & receiving his prior approval may be considered.

2.5 STAGE ACOUSTIC TILES:
A. Basis of design: CertainTeed Performa Theater Black F.
B. NRC: 0.75

C. CAC: 20
D. LR: 0.03
E. Fire Rating: Class A
F. Foil Backing: No
G. Sag Resistant
H. Mold Resistant

2.6 OTHER MATERIALS: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed & correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION: Except as modified by requirements of governmental agencies having jurisdiction, recommendations of the manufacturer as approved by the Architect, or specific directions of the Architect, install in accordance with ASTM C636 and the pertinent UL design requirements. Provide lateral bracing as required by pertinent codes and regulations. Secure lateral bracing to structural members at right angles to the direction of the partition and four ways in large ceiling areas. Provide hold-down clips for ceiling boards at fiberglass ceiling, when required by governmental agencies having jurisdiction & as indicated on drawings. Make all grid level within a tolerance of one in 1000 and straight within a tolerance of one in 1000. Install acoustical ceiling boards so linearity of facing is as directed by the Architect.

3.3 CLEANING UP: In addition to other stipulated requirements for cleaning, completely remove finger prints and traces of soil from the surfaces of grid and acoustical materials, using only those cleaning materials recommended for the purpose by the manufacturer of the material being cleaned.

09 65 13 - RESILIENT BASE

PART 1 - GENERAL

1.1 DESCRIPTION: Provide resilient tile base where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 EXTRA STOCK: Deliver to the Owner for his use in future modifications an extra stock of approximately 20 LF of each color and pattern in each material installed under this Section, packing each type of material separately, distinctly marked, and adequately protected against deterioration.

1.4 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

PART 2 - PRODUCTS

2.1 GENERAL: Provide colors and patterns as selected by the Architect from standard colors and patterns of the approved manufacturer in the specified type. Products of other manufacturers when approved in advance by the Architect will be considered.

2.2 COLOR: Color selected by Architect from manufacturer's standard.

2.3 VINYL BASE: 4" high x .080 thk x 100’ roll, by Roppe Rubber Co. or another manufacturer approved in writing by the Architect prior to bidding. Use mitered inside corners. Color selected by Architect from manufacturer's standard.

2.4 ADHESIVES: Provide waterproof and stabilized typed adhesive as recommended by the manufacturer of the material being installed. Asphalt emulsions and other non-waterproof adhesives will not be acceptable.

2.5 OTHER MATERIAL: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION: Verify that substrate is smooth, level, at required finish elevation, and without more than 1/8" in 10'-0" variation from level or slopes shown on the Drawings. Prior to laying materials, broom clean or vacuum the surfaces to be covered, and inspect the subfloors.

3.3 PRIMING: Apply concrete slab primer if so recommended by the resilient flooring manufacturer. Apply in accordance with the manufacturer's recommendations as approved by the Architect.

3.4 INSTALLING BASE: Install base at the juncture of walls to all new flooring & where shown on the Drawings. Use factory-performed exterior corners, and factory-performed or job-mitered interior corners.

3.5 CLEANING AND PROTECTING: Remove excess adhesive and other blemishes from exposed surfaces, using neutral cleaner recommended by the manufacturer of the resilient materials.

09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION: Provide resilient tile flooring and base where shown on the Drawings, as specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 EXTRA STOCK: Deliver to the Owner for his use in future modifications an extra stock of approximately 100 SF of each color and pattern in each material installed under this Section, packing each type of material separately, distinctly marked, and adequately protected against deterioration.

1.4 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

1.5 PREINSTALLATION CONFERENCE: Schedule and hold preinstallation conference minimum one week prior to beginning of work on scope addressed in this section. Coordinate scheduling of meeting with Architect so that Architect can attend meeting.

PART 2 - PRODUCTS

2.1 GENERAL: Provide colors and patterns as selected by the Architect from standard colors and patterns of the approved manufacturer in the specified type. Products of other manufacturers when approved in advance by the Architect will be considered.

2.2 STANDARD VINYL TILE: 12"x 12"x 1/8" vinyl composition floor tile, meeting requirements of Fed Spec SS-T-312B Type IV & NFPA Class 1. Material to be Armstrong “Standard EXCELON” or equal as approved by Architect prior to bidding.

2.3 LUXURY VINYL TILE: 24” x 24”, 20 mil wear layer with quartz enchanced urethane finish. Material to be Patcraft “Letterpress” or Timbergrove” or equal as approved by Architect prior to bidding.

2.4 MODULAR RESILIENT TILE: Basis of Design J+J Kinetex "Flash" & "Pop", or equal as approved by Architect.

A. Construction: Loop
B. Wear Layer: 100% Solution Dyed Polyester - Universal Fibers
C. Standard Backing: Polyester Felt Cushion
D. Dye Method: Solution Dyed
E. Pattern Repeat: N/A
F. Total Weight (nominal average): 4.5 oz - 5.2 oz/ square foot
G. Total Thickness (nominal average): 0.205 inches
H. Dimensions: 24" x 24" modules
I. Special Treatments: Kinetex ProTex®

2.5 COLOR: Color selected by Architect from manufacturer's standard, installed in a 3 color pattern in hallways & lobbys, & with an accent border in other rooms, per the Architect's instructions. Up to 20% of flooring to be from the manufacturer’s “premium patterns” group.

2.6 ADHESIVES: Provide waterproof and stabilized typed adhesive as recommended by the manufacturer of the material being installed. Asphalt emulsions and other non-waterproof adhesives will not be acceptable.

2.7 CONCRETE SLAB PRIMER: Provide non-staining type as required and as recommended by the manufacturer of the material being installed.

2.8 OTHER MATERIAL: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION: Verify that substrate is smooth, level, at required finish elevation, and without more than 1/8" in 10'-0" variation from level or slopes shown on the Drawings. Prior to laying materials, broom clean or vacuum the surfaces to be covered, and inspect the subfloors.

3.3 PRIMING: Apply concrete slab primer if so recommended by the resilient flooring manufacturer. Apply in accordance with the manufacturer's recommendations as approved by the Architect.

3.4 LAYOUT: Install materials only after finishing operations, including painting, have been completed and after permanent heating system is operating. Verify that moisture content of concrete slabs, building air temperature, and relative humidity are within the limits recommended by the manufacturers of the materials used. Maintain reference markers, holes, and openings that are in place or plainly marked for future cutting by repeating on the finish surface as marked in the subfloor. Use chalk or other non-permanent marking device.

3.5 INSTALLING RESILIENT TILES: Place units with adhesive cement in strict compliance with the manufacturer's recommendations as approved by the Architect. Butt units tightly to vertical surfaces, nosings, edgings, and thresholds. Scribe as necessary around obstructions and to produce neat joints. Place tiles tightly laid, even, and in straight parallel lines. Extend units into toe spaces, door reveals, and in closets and similar spaces. Lay units from center marks established with principal walls, discounting minor offset, so that units at opposite edges of the room are of equal width. Adjust as necessary to avoid use of cut widths less than 3" wide at room perimeters. Lay units square to axes of the room or space. Match units for color and pattern by using materials from cartoons in the same sequence as manufactured and packaged. Lay in ashlar pattern with grain in all units running the same direction, unless otherwise directed by the Architect. Place resilient edge strips tightly butted to units and secured with adhesive, providing at all unprotected edges unless otherwise shown.

3.6 INSTALLING BASE: Install base at the juncture of walls to all new flooring & where shown on the Drawings. Use factory-performed exterior corners, and factory-performed or job-mitered interior corners.

3.7 CLEANING AND PROTECTING: Remove excess adhesive and other blemishes from exposed surfaces, using neutral cleaner recommended by the manufacturer of the resilient materials.

09 72 18 - FIBERGLASS WALL PANELS

PART 1 - GENERAL

1.1 DESCRIPTION: Furnish all labor, materials, tools, & equipment as required for fiberglass wall panels, as shown on the Drawings, specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

1.4 PRODUCT HANDLING: Protect stored materials against exposure to weather and contact with moisture, providing air good circulation.

1.5 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

1.6 EXTRA STOCK: Upon completion of the work of this Section, deliver to the Owner an extra stock equaling 50 SF of each color & type of material used in the work, neatly packaged, and clearly labeling with contents and location where used.

PART 2 - PRODUCTS

2.1 WALL PANELS: Marlite "FRP Wall Panel", Crane Kemlite "Glasbord FRP Flat Panel", or another product determined by the Architect to be equal & receiving his prior approval. Color selected by Architect from manufacturers standards.

2.2 ACCESSORIES: Provide adhesive & matching trims by same manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION: Examine the areas and conditions under which work of this Section will be performed, correcting conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION: Install according to manufacturer's recommendations, in as large of pieces as possible using preformed fiberglass moldings at joints & exposed edges. Adhere to substrate using a uniform coating of adhesive as recommended by manufacturer.

09 91 00 - PAINTING

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS: Paint and finish the exterior and interior exposed surfaces listed on the Painting Schedule, as noted on the Drawings, as specified herein, and as needed for a complete and proper installation. Unless otherwise indicated, painting other than priming is not required on surfaces in concealed and inaccessible areas. Pre-finished metal surfaces will not require painting except as specified. Do not paint moving parts of operating units. Do not paint over required labels.

1.2 RELATED SECTIONS

A. 09 21 16 - GYPSUM BOARD ASSEMBLIES
B. 04 22 00 - CONCRETE UNIT MASONRY
C. 06 40 23 - INTERIOR ARCHITECTURAL WOODWORK
D. 05 12 00 - STRUCTURAL STEEL FRAMING
E. 05 21 00 - STEEL JOIST FRAMING
F. 05 40 00 - COLD-FORMED METAL FRAMING
G. 05 50 00 - METAL FABRICATIONS
H. 05 51 13 - METAL PAN STAIRS
I. 05 52 13 - PIPE AND TUBE RAILINGS
J. 13 34 19 - METAL BUILDING SYSTEM

1.3 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section. The requirements of other sections may affect the work under this section.

1.4 DEFINITIONS: "Paint," as used herein, means coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers, and other applied materials whether used as prime, intermediate, or finish coats.

1.5 QUALITY ASSURANCE: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section. Provide finish coats which are compatible with the prime coats actually used. Provide barrier coats over non-compatible primers, or remove the primer and reprime as required.

1.6 SUBMITTALS: Within 35 calendar days after the Contractor has received the Owner's Notice to Proceed, submit materials list of items proposed to be provided under this Section & manufacturer's specifications and other data needed to prove compliance with the specified requirements.

1.7 JOB CONDITIONS: Do not apply solvent-thinned paints when the temperature of surfaces to be painted and the surrounding air temperatures are below 45 degree F, unless otherwise permitted by the manufacturer's printed instructions as approved by the Architect. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted by the manufacturers' printed instructions as approved by the Architect. Applications may be continued during inclement weather only within the temperature limits specified by the paint manufacturer as being suitable for use during application & drying periods.

1.8 EXTRA STOCK: Upon completion of the work of this Section, deliver to the Owner an extra stock equaling 2 gallons of each color, type, and gloss of paint used in the work, tightly sealing each container, and clearly labeling with contents and location where used.

PART 2 - PRODUCTS

2.1 PAINT MATERIALS: Premium grade by Benjamin Moore, Pratt & Lambert, Sherwin-Williams, Devoe Paint, Negely, Certified Labs, Tnemec, Coronado, PPG or other manufacturers approved in advance by the Architect.

2.2 HIGH BUILD EPOXY COATING, LOW GLOSS (MPI #108): A two component epoxy, high solids, low gloss coating for use on interior or exterior concrete, masonry and primed metal surfaces. Metal surfaces may be primed with conventional epoxy primers, epoxy zinc rich primers or inorganic zinc rich primers.

Listing Mfr	Label	Product Name	Code

Benjamin Moore		Epoxy Mastic Coating	M45/M46
Columbia Paint	DuPont	Corlar	2.15T
Coronado Paint		Polyamide Epoxy Coating Semi-Gloss	101-251
ICI Paints	Devoe Coatings	Bar-Rust 235	235
PPG	Aquapon	High Build Epoxy Marine Coating	97-130/97-139
Sherwin-Williams	Industrial & Marine	Macropoxy 646 Fast Cure Epoxy	B58 W 6series

2.3 PENETRATING CONCRETE SEALER: Enviroseal® 40, clear, water-based, 40% silane penetrating sealer / water repellent.

2.4 PAINTING SCHEDULE:

A. INTERIOR CMU: 1 coat block filler; 2 coats scrubable semi-gloss acrylic latex wall paint.

B. PAINTED WOOD: 1 coat alkyd primer; 2 coats alkyd semi-gloss enamel.

C. TRANSPARENT WOOD FINISH: MPI #85/ Lacquer, Clear, Satin. solvent based, nitrocellulose type, clear, finishes for interior wood surfaces. Application by airless, HVLP or conventional spray equipment.

D. FERROUS METAL: 1 coat alkyd primer; 2 coats alkyd semi-gloss enamel.

E. EXPOSED STEEL STRUCTURE: Touch-up factory primer. In areas where there is no ceiling, “dry-fall” all exposed structure. One color will be used on exposed primary structure & a second on secondary structure.

F. GALVANIZED METAL: 1 coat galvanized metal primer; 2 coats alkyd semi-gloss enamel.

G. DRYWALL: Very light sprayed orange peel or rolled texture; 1 coat latex wall primer; 2 coats scrubable semi-gloss acrylic latex wall paint.

H. EPOXY PAINTED VERTICAL SURFACES: Primer or block filler as appropriate for substrate. 2 coats epoxy semi gloss.

I. CONCRETE FLOORS NOT SCHEDULED OTHERWISE: Penetrating concrete sealer.

2.5 UNDERCOATS AND THINNER: Use only the thinners recommended by the paint manufacturer, and use only to the recommended limits. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish by the same manufacture.

2.6 COLOR SCHEDULES: The Architect will prepare a color schedule with samples for guidance in painting. The Architect may select varied colors on different surfaces, with variations for ceilings, trim, doors, miscellaneous work, and metal work, subject to the following:

2.7 APPLICATION EQUIPMENT: For application of the approved paint, use only such equipment as is recommended for application of the particular paint by the manufacturer of the particular paint, and as approved by the Architect.

2.8 WET AREAS: In toilet rooms and other wet areas, add an approved fungicide to paints. For oil base paints, use 1% phenolmercuric or 4% tetrachlorophenol. For water emulsion and glue size surfaces, use 4% sodium tetrachlorophenol.

2.9 OTHER MATERIALS: Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film. Do not proceed until unsatisfactory conditions are corrected.

3.2 MATERIAL PREPARATION: Mix and prepare paint materials in strict accordance with the manufacturers' recommendations as approved by the Architect. When materials are not in use, store in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free from foreign materials and residue. Stir materials before application, producing a mixture of uniform density. Do not stir into the material any film which may form on the surface, but remove the film and, if necessary, strain the material before using.

3.3 SURFACE PREPARATION: Perform preparation and cleaning procedures in strict accordance with the paint manufacturers' recommendations as approved by the Architect. Remove or provide surface applied protection for items in place not to receive paint finish during painting operations. Clean each surface to be painted prior to applying paint or surface treatment. Remove oil and grease with clean cloths and cleaning solvent prior to start of mechanical cleaning. Schedule cleaning and painting to avoid dust and other contaminants.

A. PREPARATION OF WOOD SURFACES: Clean wood surfaces until free from dirt, oil, and other foreign substances. Smooth finished wood surfaces exposed to view, using the proper sandpaper to produce a uniformly smooth and unmarred wood surface. Unless specifically approved by the Architect, do not proceed with painting of wood surfaces until the moisture content of the wood is 12% or less.

B. PREPARATION OF METAL SURFACES: Thoroughly clean surfaces until free from dirt, oil, and grease. On galvanized surfaces, use solvent for the initial cleaning, and then treat the surface thoroughly with phosphoric acid etch. Remove etching solution completely before proceeding. Allow to dry thoroughly before application of paint. Teacup shop-applied prime coats which have been damaged, and touchup bare areas prior to start of finish coats application.

C. CEMENTITIOUS MATERIALS: Prepare cementitious surfaces of concrete, concrete block, cement plaster and cement-asbestos board to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Determine alkalinity and moisture content of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint correct this condition before application of paint. Do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

3.4 PAINT APPLICATION: Slightly vary the color of succeeding coats. Do not apply additional coats until the completed coat has been inspected and approved. Sand and dust between coats to remove defects visible to the unaided eye from a distance of five feet. On removable panels and hinged panels, paint the back sides to match the exposed sides. For completed work, match the approved Samples as to texture, color, and coverage. Remove, refinish, or repaint work not in compliance with the specified requirements.

A. BRUSH APPLICATIONS: Brush out and work the brush coats onto the surface in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.

B. SPRAY APPLICATION: Where spray application is used, apply each coat to provide the hiding equivalent of brush coats. Do not double back with spray equipment to build up film thickness of two coats in one pass.

3.5 DRYING: Allow sufficient drying time between coats, modifying the period as recommended by the material manufacture to suit adverse weather conditions. Consider oil-base and oleo-resinous solvent-type as dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and when the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

3.6 MISCELLANEOUS SURFACES: Finish exposed electric panels, access doors, conduits, pipes, ducts, grilles, registers, vents, and items, of similar nature to match the adjacent wall and ceiling surfaces, or as directed. Paint visible duct surfaces behind vents, registers, and grilles flat black. Wash metal with solvent, prime, and apply two coats of alkyd enamel. Paint prime coated hardware to match adjacent surfaces.

3.7 SEALING: Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime all surfaces of finish carpentry. When transparent finish is required, use spar varnish for backpriming. Seal tops, bottoms, and cut-outs of unprimed wood doors immediately upon delivery to job.

DIVISION 10 – SPECIALTIES

10 11 00 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Porcelain enamel chalkboards.

2. Porcelain enamel markerboards.

3. Natural-cork tackboards.

B. Related Sections include the following:

1.3 SUBMITTALS

A. Product Data: For each type of visual display board indicated. Include motor capacities and individual panel weights for sliding chalkboard and markerboard units.

B. Shop Drawings: For each type of visual display board required.

1. Include dimensioned elevations. Show location of joints between individual panels where unit dimensions exceed maximum panel length.

2. Include sections of typical trim members.

3. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors and textures available for the following:

1. Chalkboards and Markerboards: Actual sections of porcelain enamel finish for each type of chalkboard and markerboard required.

D. Product Certificates: Signed by manufacturers of tackboards certifying that vinyl-fabric-faced cork tackboard materials furnished comply with requirements specified for flame-spread ratings.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of chalkboard manufacturer for both installation and maintenance of the type of sliding chalkboard units required for this Project.

B. Source Limitations: Obtain visual display boards through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of visual display boards and are based on the products indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval and only to the extent needed to comply with performance requirements. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Fire-Test-Response Characteristics: Provide vinyl-fabric-faced tackboards with the following surface-burning characteristics as determined by testing assembled materials composed of facings and backings identical to those required in this Section per ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify vinyl-fabric-faced tackboards with appropriate markings of applicable testing and inspecting agency.

1. Flame Spread: 25 or less.

2. Smoke Developed: 10 or less.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify field measurements before preparation of Shop Drawings and before fabrication to ensure proper fitting. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.6 WARRANTY

A. General Warranty: The special porcelain enamel chalkboard warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Porcelain Enamel Chalkboard Warranty: Submit a written warranty executed by manufacturer agreeing to replace porcelain enamel chalkboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking within the specified warranty period, provided the manufacturer's written instructions for handling, installation, protection, and maintenance have been followed.

1. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Best-Rite Chalkboard Co.
2. Carolina Chalkboard Co.
3. Claridge Products and Equipment, Inc.
4. Ghent Manufacturing, Inc.
5. Greensteel, Inc.
6. Lemco, Inc.
7. Marsh Chalkboard Company.
8. Nelson Adams Company.
9. Newline Products

2.2 MATERIALS

A. Porcelain Enamel Chalkboards and Markerboards: Balanced, high-pressure-laminated, porcelain enamel chalkboards of 3-ply construction consisting of face sheet, core material, and backing.

1. Face Sheet: 0.024-inch enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturer's standard firing temperatures, but not less than 1200 deg F. Provide manufacturer's standard matte-finish cover coat, with color selected from manufacturer's standards.

2. Core: 3/8” thick, particleboard core material complying with requirements of ANSI A208.1, Grade 1-M-1.

3. Backing Sheet: 0.005-inch-thick, aluminum-foil sheet backing.

B. Natural-Cork Tackboards: Single-layer, 1/4-inch-thick, seamless, compressed fine-grain, bulletin board quality, natural-cork sheet; face sanded for natural finish; complying with MS MIL-C-15116, Type II.

2.3 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062-inch-thick, extruded-aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single-length units. Keep joints to a minimum. Miter corners to a neat, hairline closure.

1. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

2. Chalktray: Manufacturer's standard, continuous, solid, extrusion-type, aluminum chalktray with ribbed section and smoothly curved exposed ends for each chalkboard.

3. Map Rail: Furnish map rail at top of each unit, complete with the following accessories:

a. Display Rail: Provide continuous cork display rail approximately 1 or 2 inches wide, as indicated, integral with map rail.

b. End Stops: Provide one end stop at each end of map rail.

c. Map Hooks: Provide 2 map hooks for every 48 inches of map rail or fraction thereof.

d. Flag Holder: Provide one flag holder for each room.

2.4 FABRICATION

A. Porcelain Enamel Chalkboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.

B. Assembly: Provide factory-assembled chalkboard and tackboard units, unless field-assembled units are required.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.

2. Provide manufacturer's standard vertical joint system between abutting sections of chalkboards.

3. Provide manufacturer's standard mullion trim at joints between chalkboards and tackboards.

2.5 FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine wall surfaces, with Installer present, for compliance with requirements and other conditions affecting installation of visual display boards.

1. Surfaces to receive chalkboards or markerboards shall be free of dirt, scaling paint, and projections or depressions that would affect smooth, finished surfaces of chalkboards or markerboards.

2. Surfaces to receive tackboards shall be dry and free of substances that would impair the bond between tackboards and substrate.

3. Verify proper placement of blocking as required for sufficient support before proceeding.

4. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Deliver factory-built visual display boards completely assembled in one piece without joints, where possible. If dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.

B. Install units in locations and at mounting heights indicated and according to manufacturer's written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

C. Coordinate Project-site-assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.3 INSTALLATION ON EXTERIOR WALL: When unit is called to be installed on an exterior wall, provide ¼" spacer to allow for air flow behind unit.

3.4 ADJUSTING AND CLEANING

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units according to manufacturer's written instructions.

10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 DESCRIPTION: Furnish all labor, materials, tools, & equipment as required for signage, as shown on the Drawings. GENERAL: Provide signs which designate permanent rooms that may be used by the public, complying with TAS requirements for braille, character, height, finish & contrast.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section. Comply with recommendations contained in the "Americans with Disabilities Design Guidelines" & the Texas Accessibility Standards.

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

1.4 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review, to include rubbing for approval.

PART 2 - PRODUCTS

2.1 MATERIAL: Signage material & mounting to be weather & vandalism resistant.

2.2 ROOM IDENTIFICATION SIGNS: Provide 1/8" acrylic room identification signs w/ fused imbedded separately engraved characters & optically correct beaded braille. Mount beside door at each room adjoining corridor except restrooms. Text & color to be selected by Architect. Letters and numbers on signs shall have a width-to-height ratio between 3:5 and 1:1 and a stroke-width-to-height ratio between 1:5 and 1:10. Letters and numerals shall be upper case, sans serif or simple serif type at least 5/8 in (16 mm) high, but no higher than 2 in (50 mm) and shall be accompanied with Grade 2 Braille. The characters and background of signs shall be eggshell, matte, or other non-glare finish. Characters and symbols shall contrast with their background.

2.3 RESTROOM IDENTIFICATION SIGNS: Provide 1/8" acrylic room identification signs meeting the requirements above, mounted beside door at each restroom. Text & color to be selected by Architect. Provide braille text & international symbol for accessibility.

2.4 TRAFFIC SIGNAGE: Provide accessible parking & directional signage as indicated.

2.5 EXTERIOR BUILDING SIGNAGE: Provide cast aluminum stud mounted letters with chrome finish. Font to be Euro Style Ext. Bold unless noted otherwise on drawings. Refer to drawings for size & quantity.

2.6 PLAQUE: Provide one (1) 24” x 36” satin finish cast aluminum plaque with dark textured background. Text & location to be provided by Architect.

PART 3 - EXECUTION

3.1 PREPARATION: Examine the areas and conditions under which work of this Section will be performed. Correct condition detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 MOUNTING LOCATION AND HEIGHT FOR INTERIOR SIGNAGE: Where permanent identification is provided for rooms and spaces, signs shall be installed on the wall adjacent to the latch side of the door. Where there is no wall space to the latch side of the door, including at double leaf doors, signs shall be placed on the nearest adjacent wall. Mounting height shall be 60 in (1525 mm) above the finish floor to the centerline of the sign. Mounting location for such signage shall be so that a person may approach within 3 in (76 mm) of signage without encountering protruding objects or standing within the swing of a door.

3.3 INSTALLATION: Install this work in strict accordance with the original design, and the manufacturer's recommendations as accepted by the Architect. Install plaque using rossette head anchor bolts. Exterior building letters to be stud mounted. Place & attach firmly & accurately into position, square, plumb, level, & true. Protect work during storage, installation & until final acceptance, replacing any damaged material.

3.4 SIGNAGE SCHEDULE

10 21 13 - SOILID PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SCOPE

A. Requirements of the general conditions and special conditions apply to the work in this section.

B. Provide all labor, materials, etc. necessary for the completion of the work of this section as specified or shown on the drawings.

C. Work of this section consists of, but is not limited to the following:

1. Toilet compartments

2. Urinal Screens

3. Hardware, etc.

1.2 SUBMITTALS

A. Submit (6) sets of shop drawings, including details and a sample of each item of hardware (if requested) for architect's approval.

B. Provide drawings showing location for adequate steel reinforcements or wood blocking in walls to be provided by others for proper securement of the finished work.

C. Furnish color samples for use of the architect.

D. Furnish documentation on hardware, headrail, and continuous wall bracket to meet specification as outlined.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Plastic Panels: High density polyethylene (HDPE) suitable for exposed applications, waterproof, non-absorbent, and graffiti-resistant textured surface, Class C.

B. Zinc Aluminum Magnesium and Copper Alloy (Zamac): ASTM B 86.

C. Stainless Steel Sheet: ASTM A 240 or A 666, 300 series.

D. Stainless Steel Castings: ASTM A 743/A 743M.

E. Aluminum: ASTM B 221.

2.2 PLASTIC TOILET COMPARTMENTS

A. Toilet Compartment Type:

1. Overhead braced.

a. Basis of Design Product: Bradley, Mills Partitions, Bradmar Solid Plastic, Sentinel, Series 400.

B. Urinal Screen Style:

1. Floor Braced:

a. Basis of Design Product: Bradley, Mills Partitions, Bradmar Solid Plastic, Model #3.

b. 5” wide front attached post.

c. Continuous heavy-duty aluminum brackets.

C. Door, Panel, and Pilaster Construction, General: HDPE, with a 3/16" (4.8mm) radiused edge.

a. Provide exposed surfaces free of pitting, visible seams and fabrication marks, stains, or other imperfections.

b. Provide aluminum heat sink at bottom edge of panels and doors.

D. Door Construction: 1 inch thick.

E. Panel Construction: 1 inch thick.

F. Pilaster Construction: 1 inch thick.

G. Headrail: Extruded anodized aluminum headrail with anti-grip profile. Clamps around pilaster and is secured to the wall with stainless steel brackets.

H. Shoes: 4 inches high minimum, 300 series stainless steel with No. 4 satin brushed finish.

I. Urinal-Screen Construction: Matching toilet compartment panel construction

1. Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters; with shoe and sleeve (cap) matching that on the pilaster.

J. Brackets (Fittings): Full-Height (Continuous) Type: Manufacturer's standard design; heavy-duty aluminum.

K. Plastic Panel Finish: Manufacturer's standard impregnated finish, with one color in each room.

1. Color: As selected by Architect from manufacturer's full range.

2.3 HARDWARE

A. Hardware, Heavy Duty: Manufacturer's heavy-duty stainless steel, including stainless steel tamper-resistant fasteners:

1. Hinges: Self-closing continuous spring-loaded type adjustable to hold doors open at any angle up to 90 degrees, with emergency access by lifting door.

2. Latch and Keeper: Surface-mounted slide latch with flat rubber-faced combination door strike and keeper, with provision for emergency access, meeting requirements for accessibility at accessible compartments.

3. Coat Hook: Combination hook and rubber-tipped stop, sized to prevent door from hitting compartment-mounted accessories. Provide wall bumper where door abuts wall. Provide formed L-shaped hook without stop at outswing doors. Mount with stainless steel through-bolts.

4. Door Pull: Standard unit on outside of inswing doors. Provide pulls on both sides of outswing doors.

2.4 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at bottoms of posts. Provide caps, shoes, and covers at posts to conceal anchorage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine work area to verify that measurements, substrates, supports, and environmental conditions are in accordance with manufacturer's requirements to allow installation.

1. Proceed with installation once conditions meet manufacturer's requirements.

3.2 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

B. Install toilet partitions and screens in spaces with operating, temperature controlled HVAC systems. Shield partitions and screens from direct sunlight.

C. Clearances: Install with clearances indicated on Drawings. Where clearances are not indicated, allow maximum 1/2 inch between pilasters and panels, and 1 inch between panels and walls.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 15 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in privacy screens to return doors to fully closed position.

3.4 FINAL CLEANING

A. Remove packaging and construction debris and legally dispose of off-site.

B. Clean partition and screen surfaces with materials and cleansers in accordance with manufacturer's recommendations.

10 26 13 - CORNER GUARDS

PART 1 - GENERAL

1.1 SUMMARY: Corner guard system for wall protection

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
B. National Building Code of Canada (NBC)
C. National Fire Protection Association (NFPA)
D. Society of Automotive Engineers (SAE)
E. Underwriters Laboratory (UL)
F. Underwriters Laboratory of Canada (ULC)
G. Uniform Building Code (UBC)

1.3 SYSTEM DESCRIPTION

A. Performance Requirements: Provide corner guard system that conform to the following requirements of regulatory agencies and the quality control of IPC Door and Wall Protection Systems, InPro Corporation.

1. Fire Performance Characteristics: Provide UL Classified corner guards conforming with NFPA Class A fire rating. Surface burning characteristics, as determined by UL-723 (ASTM E-84), shall be flame spread of 10 and smoke development of 350 - 450. Provide ULC (Canada) listed corner guards conforming to the requirements of the National Building Code of Canada 2010, Subsection 3.1.13. Surface burning characteristics, as determined by CAN/ULC-S102.2, shall be flame spread of 15 and smoke developed of 35.

2. Self Extinguishing: Provide corner guards with a CC1 classification, as tested in accordance with the procedures specified in ASTM D-635-74, Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position, as referenced in UBC 52-4-1988.

3. Impact Strength: Provide rigid vinyl profile materials that have an Impact Strength of 30.2 ft-lbs/inch of thickness as tested in accordance with the procedures specified in ASTM D-256-90b, Impact Resistance of Plastics.

4. System Impact Resistance: Provide a corner guard system that resists an impact of 153.9 ft-lbs while producing no visual blemishes upon the vinyl cover surface and no deformations in the vinyl retainers, as tested in accordance with the applicable provisions of ASTM F 476-84, paragraph 18, Impact Test.

5. GREENGUARD Certified: Provide GREENGUARD Certified material. Profiles shall meet the requirements of GREENGUARD Certification Standards for Low-Emitting Products and GREENGUARD Product Emission Standard for Children & Schools.

6. Chemical and Stain Resistance: Provide corner guards that show resistance to stain when tested in accordance with applicable provisions of ASTM D-543.

7. Fungal and Bacterial Resistance: Provide rigid vinyl that does not support fungal or bacterial growth as tested in accordance with ASTM G-21 and ASTM G-22.

8. Color Consistency: Provide components matched in accordance with SAE J-1545 - (Delta E) with a color difference no greater than 1.0 units using CIE Lab, CIE CMC, CIE LCh, Hunter Lab or similar color space scale systems.

1.4 SUBMITTALS

A. Product Data: Manufacturer’s printed product data for each type of corner guard specified.

B. Detail Drawings: Mounting details with the appropriate fasteners for specific project substrates.

C. Samples: Verification samples of corner guard, 8" (203mm) long, in full size profiles of each type and color indicated.

D. Manufacturer's Installation Instruction: Printed installation instructions for each corner guard.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in unopened factory packaging to the jobsite

B. Inspect materials at delivery to assure that specified products have been received.

C. Store in original packaging in a climate controlled location away from direct sunlight.

1.6 PROJECT CONDITIONS: Products must be installed in an interior climate controlled environment.

1.7 WARRANTY: Limited Lifetime Warranty against material and manufacturing defects.

PART 2 - PRODUCTS

2.1 SCOPE: Provide corner guards at all exterior corners at Gymnasium, Cafeteria, Lobbies, Vestibules, Custodial, Maintenance, Vocational Shops, Stages, Weight Rooms, Exercise Rooms and as called out on drawings.

2.2 MANUFACTURER

A. Basis of Design: IPC Door and Wall Protection Systems, InPro Corporation, PO Box 406 Muskego, WI 53150 USA;

B. Substitutions: As approved by Architect prior to bidding.

C. Provide all corner guards and wall protection from a single source.

2.3 MANUFACTURED UNITS

A. Corner Guard System
1. 160BN BluNose High Impact Corner Guard Profile
2. 2" (51mm) x 2" (51mm), 90 degree
3. 3' (.91m), 4' (1.22m), 8' (2.44m) and 9' (2.74m) standard heights
4. Custom heights available
5. Custom Angles – Provide vinyl covers and retainers with custom angles. Custom angles shall be between 112.5° and 157.5°. Provide flexible top caps to bend to retainer angle.

2.4 MATERIALS

A. Vinyl Covers: Snap on cover of .080" (2mm) thickness shall be extruded from chemical and stain resistant polyvinyl chloride with the addition of impact modifiers. No plasticizers shall be added (plasticizers may aid in bacterial growth).

B. Vinyl Retainers: Continuous vinyl retainers of .070" (1.8mm) thickness with a co-extruded flexible vinyl apex shall be fabricated from polyvinyl chloride with the addition of impact modifiers.

2.5 COMPONENTS

A. Top caps and bottom caps shall be made of injection molded thermoplastics.

B. Fasteners: All mounting system accessories appropriate for substrates indicated on the drawings shall be provided.

C. Optional flexible top caps shall be made of injection molded flexible PVC.

2.6 FINISHES

A. Vinyl Covers: Colors of the corner guard to be selected by the architect from the IPC finish selection. Surface shall have a pebblette texture.

B. Molded Components: Top caps and bottom caps shall be of a color matching the corner guards. Surface shall have a pebblette texture.

PART 3 - EXECUTION

3.1 EXAMINATION: Examine areas and conditions in which the corner guard systems will be installed. Complete all finishing operations, including painting, before beginning installation of corner guard system materials. Wall surface shall be dry and free from dirt, grease and loose paint.

3.2 PREPARATION: Prior to installation, clean substrate to remove dust, debris and loose particles.

3.3 INSTALLATION

A. General: Locate corner guard as indicated on the approved detail drawings for the appropriate substrate and in compliance with the IPC installation instructions. Install corner guard level and plumb at the height indicated on drawings.

B. Installation of 160BN BluNose High Impact Surface Mount

1. Corner Guard:

a. Retainer Installation

i Position the vinyl retainer against the wall, allowing 5/16" (8mm) from the bottom of the retainer to the top of the cove base or baseboard for the bottom cap.

ii Drywall: Secure the retainer to the wall using #8 x 1-1/4" Phillips round head, self-tapping screws. Stagger the fasteners on each wing of the retainer. Use 4 screws per 3' (.91m) length, 6 screws per 4' (1.22m) length, 10 screws per 8' (2.44m) length, or 12 screws per 9' (2.74m) length.

iii Concrete: Drill 1/4" (6.5mm) holes into the ends of the retainer for the top and bottom caps. Stagger the holes on each wing of the cap. Use the slotted tabs on the top and bottom cap to transfer hole location to the retainer. Drill 1/4" (6.5mm) holes on the two wings of the retainer. Stagger the fasteners on each wing of the retainer. Drill 4 holes per 3' (.91m) length, 6 holes per 4' (1.22m) length, 10 holes per 8' (2.44m) length, or 12 holes per 9' (2.74m) length. Transfer the location of all mounting holes to the wall. Drill 1/4" (6.5mm) holes and position ALLIGATOR anchors into the holes on the wall. Mount the retainer with #10 x 1-3/4" Phillips pan head screws and tighten to secure the retainer to the wall.

b. Top and Bottom Cap Installation:

i Drywall: Overlap the retainer with the mounting tabs of the top and bottom caps and attach them to the retainer using two, #8 x 1-1/4" phillips flat head, self-tapping screws per cap. Stagger the fasteners on each wing of the cap.

ii Concrete: Overlap the retainer with the mounting tabs of the top and bottom caps and attach them to the retainer and into the ALLIGATOR anchors using two, #8 x 1-1/2" phillips flat head screws per cap. When installing flexible top caps on custom angle corner guards, use cup washers and flat head screws to fasten the top caps to the retainer.

iii Position the vinyl cover on the retainer to check the fit. Adjust the top cap on the retainer to obtain a tight fit with the vinyl cover. Starting at the top, push the vinyl cover over the retainer pressing over the entire length until the cover snaps securely into place.

3.4 CLEANING: At completion of the installation, clean surfaces in accordance with the IPC clean-up and maintenance instructions.

10 28 00 - TOILET, BATH AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUBMITTALS: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified. Product Schedule, indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

1.3 COORDINATION: Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Subject to compliance with requirements, manufacturers offering accessories that may be incorporated into the Work include, but are not limited to, the following:

A. Bobrick Washroom Equipment, Inc.
B. Bradley Corporation.
C. General Accessory Manufacturing Co.
D. ASI

2.2 ACCESSORY SCHEDULE:

A. GRAB BAR: At each HC accessible toilet, HC shower & where shown on drawings, provide 0.05” thk stainless-steel grab bar, 1-1/4 inches OD for medium-duty applications. Mounting to be concealed with manufacturer's standard flanges and anchors. Gripping Surfaces to be manufacturer's standard slip-resistant texture.

B. MOP AND BROOM HOLDER: In each janitor’s closet & where shown on drawings, provide mop and broom holder, 36-inch-long unit fabricated of minimum nominal 0.0375-inch-thick, stainless-steel hat channel with four spring-loaded, rubber, cam-type, mop/broom holders.

C. UNDERLAVATORY GUARD: At all exposed lavatory piping, provide underlavatory guard. Insulating piping coverings to be white, antimicrobial, molded-vinyl covering for supply and drain piping assemblies intended for use at accessible lavatories to prevent direct contact with and burns from piping. Provide components as required for applications indicated with flip tops at valves that allow service access without removing coverings.

D. SANITARY NAPKIN DISPOSAL UNIT: At each women’s toilet stall & where shown on drawings, provide stainless-steel sanitary napkin disposal unit, to be partition-mounted, dual-access type with adjustable flanges for partition mounting to serve two toilet compartments; self-closing door; and reusable receptacle that is removable from one side.

E. MIRROR UNIT: At each lavatory & where shown on drawings provide stainless-steel, channel-framed mirror. Fabricate frames for glass-mirror units to accommodate glass edge protection material. Provide mirror backing and support system that permits rigid, tamper-resistant glass installation and prevents moisture accumulation.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct condition detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected. Coordinate this work with interfacing work to ensure proper sequencing.

3.2 INSTALLATION: Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Provide wood blocking at drywall partitions. Install units level, plumb, and firmly anchored in locations and at heights indicated. Secure mirrors to walls in concealed, tamper-resistant manner with special

hangers, toggle bolts, or screws. Set units level, plumb, and square at locations indicated, according to manufacturer's written instructions for substrate indicated. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

3.3 FABRICATION: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible. Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

3.4 ADJUSTING AND CLEANING: Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings. Clean and polish exposed surfaces according to manufacturer's written recommendations.

10 44 16 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY: Provide portable fire extinguishers and cabinets. Provide mounting brackets where no cabinet is indicated. Submit for approval shop drawings, product data.

1.2 QUALITY ASSURANCE: Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."

1.3 SUBMITTALS: Shop Drawings for overall sizes and details of fabrication and erection, relationship to adjacent construction, showing anchorage, hardware, accessories, and finishes. Submit manufacturer's technical data, including descriptive data for products & installation instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
A. Fire-Protection Cabinets:
B. General Accessory Manufacturing Co.
C. J.L. Industries, Inc.
D. Larsen's Manufacturing Company.
E. Modern Metal Products; Div. of Technico.
F. Samson Products, Inc.

2.2 FIRE EXTINGUISHERS: UL listed and labeled units. At areas other than kitchen or food preparation, provide 10 lb, multi-purpose ABC dry chemical type. At kitchen or food preparation areas provide 10lb, BC dry chemical type.

2.3 CABINETS: UL listed and labeled units. Semi-recessed with door & mounting hardware.

A. At metal stud partitions less than 6”: Basis of design to be Larsen Manufacturing 2409, semi-recessed. At athletic areas, corridors and lobbies provide rolled edge frame.

B. At metal stud partitions 6” and greater: Basis of design to be Larsen Manufacturing 2409-RT, fully recessed.

C. At block partitions: Basis of design to be Larsen Manufacturing 2409-6R, 2-1/2” semi-recessed. At athletic areas, corridors and lobbies provide rolled edge frame.

D. Door & Glazing style: Basis of design to be Larsen Manufacturing Vertical Duo with clear acrylic glazing.

E. Lettering: To be red in vertical style.

F. Handles: To be manufacturer typical, except at athletic areas provide recessed handle.

G. Materials: Trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.

H. Fire-Rated Cabinets: Listed and labeled to meet requirements of ASTM E 814 for fire-resistance rating of wall where it is installed.

PART 3 - EXECUTION

3.1 PREPARATION: Examine the areas and conditions under which work of this Section will be performed. Correct condition detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION: Install at locations and heights indicated and acceptable to authorities having jurisdiction. Install cabinets plumb and level at heights acceptable to authorities having jurisdiction. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections. Restore damaged finishes and test for proper operation. Cabinets to maintain the fire rating of installed wall assembly. Clean and protect completed work from damage.

10 51 13 - KNOCK-DOWN LOCKERS

PART 1 - GENERAL

1.1 SCOPE OF WORK: Furnish and install K.D. knock-down Metal Corridor and Employee Lockers, complete, as shown and specified per contract documents including metal bases, slope tops and filler panels.

1.2 QUALITY ASSURANCE: Provide metal lockers that are standard products of a single manufacturer, with interchangeable like parts. Include necessary mounting accessories, fittings, and fastenings. Firm experience (minimum 5 years) in successfully producing the type of metal lockers indicated for this project, with sufficient production capacity to produce required units without causing delay in the work. Engage an experienced (minimum 2 years) installer who has successfully completed installation of the type of metal lockers and extent to that indicated for this project.

1.3 SUBMITTALS: Submit drawings showing locker types, sizes, quantities, including all necessary details relating to anchoring, trim installation and relationship to adjacent surfaces. Provide color charts showing manufacturer's available colors (minimum 24). Provide metal samples if requested. Locker numbering sequence will be provided by the approving authority and noted on approved shop drawings returned to locker contractor.

1.4 PRODUCT HANDLING: All work shall be fabricated in ample time so as to not delay construction process. All materials shall be delivered to the site at such a time as required for proper coordination of the work. Materials are to be received in the manufacturer's original, unopened packages and shall bear the manufacturer's label. Store all materials in a dry and well ventilated place adequately protected from the elements.

1.5 GUARANTEE: Submit upon completion of the work, covering all defects in materials and workmanship excluding finish, damage resulting from deliberate destruction and vandalism under this section for a period of 2 years from the date of final acceptance by the owner.

PART 2 - PRODUCTS

2.1 AVAILABLE MANUFACTURERS: Subject to compliance with the design, material, method of fabrication and installation as required in this specification section or modified as shown on drawings. Manufacturers offering products which may be incorporated in the work include, but are not limited to:

A. List Industries Inc. (Basis of Design)
B. Art Metal Products; Div. of Fort Knox Storage Co.
C. DeBourgh Manufacturing Co.
D. Penco Products, Inc.
E. Lyon Metal Products, Inc.

2.2 MATERIAL

A. STEEL: All sheet steel used in fabrication shall be prime grade free from scale and imperfections and capable of taking a heavy coat of high gloss baked enamel.

B. FASTENERS: Cadmium, zinc or nickel plated steel; bolt heads, slotless type; self locking nuts or lock washers.

C. EQUIPMENT: Hooks and hang rods of cadmium plated or zinc plated steel or cast aluminum. Stainless Steel recessed handle. Number Plates: To be polished aluminum with not less that 3/8" high etched numbers attached to door with two aluminum rivets.

D. FABRICATION: Fabricate lockers square, rigid and without warp, with metal faces flat and free from dents or distortion. Make all exposed metal edges safe to touch. Weld frame members together to form rigid, one-piece structure. Weld, bolt, or rivet other joints and connections as standard with manufacturer. Grind exposed welds flush. Do not expose bolts or rivet heads on fronts of locker doors or frames.

E. FINISHING: All locker parts to be cleaned and coated after fabrication with a seven stage zinc/iron phosphate solution to inhibit corrosion, followed by a coat of high grade enamel electrostatically sprayed and baked at 325 degrees Fahrenheit for a minimum of 30 minutes to provide a tough durable finish. Color to be selected from manufacturer's standard list of

colors. Two-Tone Color Combination Shall be at no additional cost with the locker body, frame and trim chosen from one standard color and the doors chosen from a second standard color.

2.3 LOCKER TYPES: Lockers shall equal to "SUPERIOR - MARQUIS STUDENT" as manufactured by List Industries Inc. or approved equal. All body parts solid.

A. FRAME: Fabricate of 16 gauge (minimum) channels, with integral continuous door stop/strike formed on vertical members

B. WARDROBE DOORS: Outer door to be fabricated from single sheet prime 14 gauge with 7/8" bends at top and bottom and 3/4" double bends at the sides with a minimum 3" wide 18 gauge full height channel door stiffener MIG welded to the inside of door face at the hinge side as well as to the top and bottom return bends.

C. DOOR RECESSED LOCKER HANDLE: All locker doors shall have recessed stainless steel cup and handle shaped to receive a built-in combination lock with key override. The recess pan shall be deep enough to have the lock be flush with the outer door face. The pull handle shall be the full width of the recess pan, fabricated of stainless steel and be welded to the recess pan flush with the door face for easy opening of the locker door.

D. LATCH ASSEMBLY: Shall be single point rigid non-moving positive latch by means of a heavy gauge (minimum 12 gauge) latch securely welded to the 14 gauge Vertical frame member. The latch assembly must be made of a single piece of steel and have a built-in combination lock with key override. A pry resistant lug which inserts into the door shall be an integral part of the 12 gauge latch. Rubber bumpers shall be securely attached to the door strike. If built-in locks are to be used on openings 30" high or higher, a 14 gauge horizontal support channel (HSA) shall be bolted to the side panel and the back side of the latch as a reinforcement.

E. DOOR HINGES: Shall not be less than 3-1/2" long 13 gauge seven knuckle pin type, securely riveted to frame and welded to the door. Doors are to be secured to frame with a minimum of two tamper resistant countersunk rivets per hinge. Provide 3 hinges for doors 48" and higher and 2 for doors shorter that 48".

F. BODY: Fabricate back and sides of 24 gauge (minimum) sheet steel, with double flanged connections extending full height. Form top, bottom and intermediate tier dividers of 24 gauge (minimum) sheet steel with single return bends at all sides. Bolt to front horizontal frame members in addition to side panels. Form hat shelves at single tier lockers of 24 gauge (minimum) sheet steel with single bends at sides and back and a double bend at front.

2.4 LOCKER ACCESSORIES: Built-In Combination Locks (Spring Bolt Action) with (5) Master / Control keys. Single tier lockers: Hat shelf, one double prong ceiling hook and not less than three single prong wall hooks. Multi tier lockers: One double prong ceiling hook and not less than three single prong wall hooks. (Two single prong wall hooks only at 9" wide). Finished End Panels Shall be "Boxed" type formed from 16 gauge cold rolled steel with 1/2" O.D. double bends on sides and a single bend at top and bottom with no exposed holes or bolts. End panels must be formed with slope at top to cover the ends of the continuous slope tops. Finish to match lockers. Provide at all exposed ends. Continuous Slope Tops Not less than 20 gauge sheet steel, approximately 18 degrees pitch, in lengths as long as practical but not less than four lockers. To be installed in addition to the locker flat top with end closures for support. Finish to match lockers. Provide fillers where indicated, of not less than 18 gauge sheet steel, factory fabricated and finished to match lockers.

PART 3 - EXECUTION

3.1 INSTALLATION: Installation shall be in strict conformance with referenced standards, the manufacturer's written directions, as shown on the drawings and as herein specified.

3.2 PLACEMENT: Lockers shall be set in place, plumb, level, rigid, flush and securely attached to the wall (or bolted together if back-to-back) and anchored to the floor or base according to manufacturer's specifications.

3.3 ANCHORAGE: About 48" o.c., unless otherwise recommended by manufacturer, and apply where necessary to avoid metal distortion, using concealed fasteners. Friction cups are not acceptable.

3.4 TRIM: Sloping tops and metal fillers shall be installed using concealed fasteners. Provide flush, hairline joints against adjacent surfaces.

3.5 ADJUSTMENT: Upon completion of installation, inspect lockers and adjust as necessary for proper door operation. Touch-up scratches and abrasions to match original finish.

10 73 16 - ALUMINUM CANOPIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-I Specification Sections, shall apply to work specified in this Section.

1.2 GENERAL DESCRIPTION OF WORK: Work in this section shall include design, fabrication and installation of complete welded, extruded aluminum (and acrylic) protective cover system. All work shall be in complete accordance with the drawings and this specification.

1.3 REFERENCES

A. Specifications for Aluminum Structures, Sixth Edition, 1994.

B. ASCE 7-95, Minimum Design Loads for Buildings and Other Structures, December 1995.

C. American Architectural Manufacturers Association (AAMA)

D. American Society for Testing and Materials (ASTM)

1.4 RELATED SECTIONS

A. 03 30 00 - CAST-IN-PLACE CONCRETE

B. Division 04 MASONRY

C. 05 50 00 - METAL FABRICATIONS

D. 07 62 00 - SHEET METAL FLASHING AND TRIM

E. 07 92 00 - JOINT SEALANTS

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product information, specifications and installation instructions for building components and accessories.

B. Shop Drawings: Submit complete shop drawings including all necessary plan dimensions, elevations and details. General Contractor shall verify all dimensions and provide elevations at each column, finish floor, and related soffit before releasing to manufacturer for fabrication.

C. Certification: Submit design calculations signed by a Registered Professional Engineer, licensed in the project state. Design calculations shall state that the protective cover system design complies with the wind requirements of ASCE 7-95, the stability criteria of applicable building code, and all other governing criteria. QUALITY ASSURANCE: Protective Cover shall be wholly produced by a recognized manufacturer with at least five years experience in the design and fabrication of extruded aluminum walkway cover systems. Components shall be assembled in shop to greatest extent possible to minimize field assembly. Protective cover shall be installed by manufacturer. Third party installation is not acceptable. Protective cover system, including material and workmanship, shall be warranted from defects for a period of one year from substantial completion of installation.

1.6 PREINSTALLATION CONFERENCE: Schedule and hold preinstallation conference minimum one week prior to beginning of work on scope addressed in this section. Coordinate scheduling of meeting with Architect so that Architect can attend meeting.

PART 2 - PRODUCTS

2.1 MANUFACTURERS: Contract documents are based on products manufactured by Avadek Walkway Covers & Canopies, Houston, TX. Approved alternate manufacturers are:
A. E.L. Burns Company, Shreveport, LA
B. Peachtree Protective Covers, Inc., Hiram, GA

2.2 DESIGN: Protective cover shall be all welded extruded aluminum system complete with internal drainage. Non-welded systems are not acceptable. Roll formed deck is not acceptable. Expansion joints shall be included to accommodate temperature changes of 120oF. Expansion joints shall have no metal to metal contact.

2.3 MATERIALS: All sections shall be extruded aluminum 6063 alloy, heat treated to T-6 temper. Sheet acrylic shall be equal to Rohm & Haas Plexiglas7 extruded acrylic per ASTM D1547. Polycarbonate glazing shall be equal to G.E. Lexan7. Fasteners shall be aluminum, 18-8 stainless steel or 300 series stainless steel. Aluminum columns embedded in concrete shall be protected by clear acrylic. Grout shall be 2000 p.s.i. compressive strength, 1 part Portland cement and 3 parts masonry sand; Add water to produce pouring consistency. Gaskets shall be dry seal santoprene pressure type.

2.4 COMPONENTS: Columns shall be radius-cornered tubular extrusion of size shown on drawings with cutout and internal diverter for drainage where indicated. Circular downspout opening in column not acceptable. Beams shall be open-top tubular extrusion of size and shape shown on drawings, top edges thickened for strength and designed to receive deck members in self-flashing manner. Structural ties shall be installed in tops of all beams. Deck shall be extruded self-flashing sections interlocking into a composite unit. Closures at deck ends shall be welded plates. Fascia shall be manufacturer's standard shape. Size as indicated on drawings. Flashing shall be .040 aluminum (min.). All thru-wall flashing by others. Arches for barrel vault protective covers shall be sharp-cornered tubular extrusions of size shown in drawings.

2.5 FABRICATION: Beams and columns shall be factory welded with neatly mitered corners into one-piece rigid bents. All welds shall be smooth and uniform using an inert gas shielded arc. Suitable edge preparation shall be performed to assure 100% penetration. Grind welds only where interfering with adjoining structure to allow for flush connection. Field welding is not permitted. Rigid mechanical joints shall be used when shipping limitations prohibit the shipment of fully welded bents. Deck shall be manufactured of extruded modules that interlock in a self-flashing manner. Interlocking joints shall be positively fastened at 8" O.C. creating a monolithic structural unit capable of developing the full strength of the sections. The fastenings must have minimum shear strength of 350 pounds each. Deck shall be assembled with sufficient camber to offset dead load deflection.

2.6 FINISH: Factory flouropolymer (Kynar) finish, specify AAMA 605.2, two coat. Color shall be selected by architect.

PART 3 - EXECUTION

3.1 PREPARATION: Erection shall be performed after all concrete, masonry, and roofing work in the vicinity is complete and cleaned.

3.2 INSTALLATION: Column sleeves (styrofoam blockouts) or anchor bolts (if required) shall be furnished by Peachtree Protective Covers, Inc. and installed by the General Contractor. Protective cover shall be erected true to line, level and plumb. Aluminum columns embedded in concrete shall be protected by clear acrylic. Downspout columns shall be filled with grout to the discharge level to prevent standing water. Non-draining columns shall have weep holes installed at top of concrete to remove condensation.

3.3 FOOTINGS AT FLATWORK: If column is installed into flatwork in a two-stage process (i.e. not pouring column into a footing), contractor shall provide expansion material and sealant at cold joint and finish to match surrounding concrete in appearance.

3.4 CLEANING: All protective cover components shall be cleaned promptly after installation.

3.5 PROTECTION: Extreme care shall be taken to protect materials during and after installation.

10 95 10 - MISC. ACCESSORIES AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION: Furnish all labor, materials, tools, & equipment as required for all Misc. Accessories & Equipment, as shown on the Drawings, specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

1.4 PRODUCT HANDLING: Protect stored materials against exposure to weather and contact with moisture, providing air good circulation.

1.5 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

PART 2 - PRODUCTS

2.1 GENERAL: Provide materials which are compatible with any underlying material. Provide all accessories required for a complete and proper installation, as recommended by the manufacturer.

2.2 COAT HOOKS: 2 Hook, side-by-side. Material: Aluminum with natural aluminum finish. Hook height: minimum 1-1/2”. Hook width: minimum 1-1/8".

2.3 NURSE’S CUBICLE TRACK AND CURTAINS

A. Cubicle Tracks: Basis of design: CS Cubicle Curtains #6063 suspended-mounted tracks of heavy extruded aluminum alloy 6063-T4, 1 3/8" x 3/4", slotted to receive roller carriers, complete with accessories and components required for complete and secure installations including splices, end caps and corner bends.

B. Carriers: Basis of Design: CS Cubicle Curtains 1062N, virgin nylon axle with nylon wheels complete with nickel-plated brass bead-chain and hook assembly. Provide one carrier for each 6" of cubicle curtain width.

C. Curtains: Provide 100% polyester curtains. Fabric is to be opaque, washable, flame retardant and closely woven. Manufacturer standard antimicrobial treatment applied to the selected cubicle curtain fabric.

D. Alternative Products: Alternative manufacturers and systems allowes as reviewed and approved by the Architect.

PART 3 - EXECUTION

3.1 UTILITY COORDINATION: Coordinate & verify that all required utility services are provided by other subcontractors or provide those required under the work of this section.

3.2 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct condition detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected. Coordinate this work with interfacing work to ensure proper sequencing.

3.3 INSTALLATION: Install this work in strict accordance with the original design, requirements of governmental agencies having jurisdiction, and the manufacturer's recommendations as accepted by the Architect. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Provide wood blocking at drywall partitions. Place & attach all components firmly & accurately into position, square, plumb, level, & true.

3.4 PROTECTION/CLEANING: Protect work during storage, installation & until final acceptance, replacing any damaged material. Clean completed work, removing excess material and blemishes from exposed surfaces, using cleaner recommended by the manufacturer.

DIVISION 12 – FURNISHINGS

12 21 13 - WINDOW BLINDS

PART 1 - GENERAL

1.1 DESCRIPTION: Furnish all labor, materials, tools, & equipment as required to provide 1" aluminum louver mini-blinds at the following locations:

A. All exterior windows (excluding entries)

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 COORDINATION: Cooperation by Contractor for work of this section with all other trades is mandatory so that all phases of work may be properly coordinated without delays or damage to any parts of the work.

1.4 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

PART 2 - PRODUCTS

2.1 BLINDS: Horizontal 1" mini-blinds by "Levolor", SWF Contract, or another product determined by the Architect to be equal & receiving his prior approval. Provide all accessories required for a complete and proper installation, as recommended by the manufacturer. Provide colors/patterns as selected by the Architect from the manufacturer's standard selection.

2.2 SUPPLEMENTARY MATERIALS: Furnish and install any supplementary materials, whether or not specifically indicated, required for a complete and proper installation, as selected by the Contractor subject to the acceptance of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct condition detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 PREPARATION: Take field measurements before fabrication where possible so as not to delay job progress. Coordinate this work with interfacing work to ensure proper sequencing. Inspect installed work of other trades and verify its completion to a point where this work may continue. The Contractor is responsible for verifying dimensions & conditions; in event of discrepancy, notify Architect prior to installation.

3.3 INSTALLATION: Install this work in strict accordance with the original design, and the manufacturer's recommendations as accepted by the Architect. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Place & attach all components firmly & accurately into position, square, plumb, & level.

3.4 PROTECTION/CLEANING: Protect work during storage, installation & until final acceptance, replacing any damaged material. Clean completed work, using cleaner recommended by the manufacturer.

DIVISION 13 – SPECIAL CONSTRUCTION

13 34 19 - METAL BUILDING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED: The pre-engineered metal building system shall be design-build, to include the design of all structure required for all building elements and construction of entire structure as designed.

A. STRUCTURAL & ENEVELOPE DESIGN: Structural design to include all building elements, except as specifically noted in the drawings. Structural design shall take into consideration design loads to include but not be limited to support of exterior walls including masonry, roof structure, projecting elements from building, interior walls, supported elements on the perimeter of the building and the interior of the building. Design building envelope and insulating systems to prevent intrusion of water, wind, vermin and bats and to meet energy code locally applicable.

B. BUILDING STRUCTURE & ENVELOPE: Building structure to be provided complete with structural framing (columns, rafters, struts, purlins, girts); wind beams to support exterior walls; metal roof & wall panels; roof and wall insulation; building canopies; metal flashings; trim; gutters and downspouts; wind and lateral bracing; fasteners; closure pieces; and roof and wall accessories and other components and material required for a complete installation. Provide building envelope to prevent intrusion of wind, water, vermin and bats; provide insulation system to meet energy code locally applicable.

1.2 DESCRIPTION: Clear & multispan gabled or single slope rigid frame structure with uniform or variable depth column and uniform or variable depth rafter sections of shop welded steel plates or open web rafter sections, supported by intermediate steel pipe or square tube columns or intermediate uniform depth columns. Column spacing as shown on drawings.

1.3 QUALITY ASSURANCE: Metal building manufacturer shall be certified in accordance with American Institute of Steel Construction (AISC) quality certification program category MB for metal buildings. This certification is to cover areas of general management, engineering and drafting, procurement, operations and quality control. Upon request the manufacturer shall provide proof of certification.

1.4 CODES AND STANDARDS:

A. Use following where applicable in building design:
1. AWS D1.1 "Structural Welding Code-Steel."
2. MBMA "Low-Rise Building Systems Manual"
3. AISI "Specifications for the Design of Cold Formed Steel Structural Members".
4. AISC "Steel Construction Manual" and "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."
5. AAMA "Aluminum Construction Manual."
6. AISC "Specification for Structural Joints Using ASTM A325 or ASTM A490 bolts."

B. Use the following where applicable in other phases of design:
1. Building Code and regulations of other governing authorities having jurisdiction.
2. Applicable portions of the Structural Steel Painting Council (SSPC) Standards, as referenced herein.
3. Federal (Fed. Spec.), Military (MIL) and Commercial (CS) Standards and Specifications, as referenced herein.
4. American Society for Testing and Materials (ASTM), Standards as referenced herein.
5. Underwriters' Laboratories, Inc. (UL Classification 90).

1.5 DESIGN CRITERIA: international Building Code (IBC), latest edition, for building location. Vertical live load 20 PSF. Roof Covering Design to support either 50 PSF uniformly distributed or 200 lb. concentrated (point) load (over 1' x 1' area) located at center of maximum roofing (panel) span; most severe condition shall govern. Design structure for code required wind load, velocity proportioned and applied as horizontal and uplift forces according to MBMA Low-Rise Building Systems Manual design practices. Steel frame to provide lateral support for masonry walls.

A. DESIGN COORDINATION: Manufacturer will review all drawings & coordinate design to accommodate all other construction systems; components found by the Architect not to be properly coordinated will be re-engineered, modified & reinstalled with no additional charge or schedule disruption.

1.6 ALLOWABLE DEFLECTION: All wind beams to be designed by building manufacturer with a deflection criteria of L/360. Building drift to be H/240 per the structural notes. At other locations, deflection of sheeting, secondary and primary structural members shall at a minimum meet the requirements for the building type & location called for under the most recent IBC, AISC & MBMA. All structural members shall be designed within deflection limits under maximum loading conditions so as to not cause movement or cracking in masonry walls or other architectural elements.

1.7 CONCEPTUAL FRAMING DIAGRAMS: Any conceptual framing diagrams provided by the Architect are meant only to communicate design intent and are not inclusive of all structural elements required under this specification.

1.8 SUBMITTALS: (1) Design Calculations and Erection Drawings prepared by, or under direct supervision of, Registered Professional Engineer, licensed to practice in State of Texas with all drawings and calculations bearing his seal. Show each type structural building frame required and their locations within structure; details of anchor bolt settings; sidewall, endwall, and roof framing; diagonal bracing and location within structure; metal floor deck and joist types; wall and roof insulation and types; longitudinal and transverse cross sections; details of curbs, roof jacks, and items penetrating roof; canopy framing and details; trim, gutters, downspouts, liner panels, wall and roof coverings, and all accessory items; materials; finishes; construction and installation details; and other pertinent information required for proper and complete fabrication, assembly and erection of watertight metal building system. (2) Color sample sets showing full color range available, for selection purposes. (3) Manufacturer's specifications and descriptive literature. (4) Written certification, prepared and signed by Registered Professional Engineer licensed to practice in State of Texas, attesting that building design meets specified loading requirements, requirements of codes and authorities having jurisdiction at project site, and other requirements specified. (5) Manufacturer's certification that the roof system shall qualify for UL Class 90.

A. CODE COMPLIANCE: It shall be the responsibility of the contractor to ensure that submitted design meets all locally applicable building and energy codes.

1.9 PRODUCT HANDLING, DELIVERY AND STORAGE: Deliver and store prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed. Stack materials on platforms or pallets above grade or on concrete slab, covered with opaque tarpaulins or other approved weather-resistant ventilated covering. Store metal sheets and panels if subjected to water accumulation in such a manner so they will drain freely. Do not store sheets and panels in contact with other materials which might cause staining. Damaged material must be reported to determine if replacement is required. Inspect panels to prevent moisture between panels, and secure as required.

1.10 WARRANTIES: Manufacturer, contractor & installer to jointly & unconditionally warrant the workmanship & the completed assembly against leaks for a period of two (2) years. Manufacturer to provide twenty (20) year paint finish & no-perforation warranty (NDL) of wall & roof panels. Warranties to provide for full & immediate replacement of defective work upon notification by Owner during the warranty period.. When two manufacturers supply the structure and the roof panels separately, both manufacturers shall furnish to the Architect certification with shop drawings that they approve of the other manufacturer and all warranties and guarantees will be in effect.

1.11 PREINSTALLATION CONFERENCE: Schedule and hold preinstallation conference minimum one week prior to beginning of work on scope addressed in this section. Coordinate scheduling of meeting with Architect so that Architect can attend meeting.

PART 2 - PRODUCTS

2.1 ACCEPTED MANUFACTURERS: The product of the following manufacturers' is acceptable provided that they comply with the remainder of this Specification. Products of the other manufacturers not listed below will be considered, provided complete design information is submitted to the Architect for approval seven days prior to the proposal.

A. Alliance Steel Buildings
B. LMB Steel Structures Inc.
C. Ceco Building Systems
D. Varco-Pruden Buildings
E. Whirlwind
F. Red Dot Buildings

2.2 STRUCTURAL STEEL: Structural Plate or Bar Stock, Minimum yield strength (Fy) of 50,000 PSI. Cold Formed Structural Steel, Minimum yield strength (Fy) of 55,000 PSI. Primary Structural Bolts and Nuts, ASTM A325; size and quantity required by metal building system manufacturer. Provide wall anchors, bearing plates, ceiling extensions, beam bolts, and other accessories necessary or required for complete installation. Join structural members fabricated of plate or bar stock together by continuous automatic submerged arc welding process with all welding performed under the supervision of certified welders in accordance with standard practices of AWS D1.1. Make all primary rigid frame field-bolted connections with A325 high-strength bolts of size required by building system manufacturer. Clean all components of oil, dirt, loose scale, and foreign matters. Factory paint with one (1) coat of manufacturer's standard primer.

2.3 PRIMARY FRAMING: Rigid frames of shop-welded steel plate columns and rafters, both tapered and uniform depth sections as required by drawings, complete with all necessary stiffeners, connection plates and holes for field-bolted assembly. Columns and Rafters, fabricated with holes in web and/or flanges for attachment of secondary members. Splice Plates, factory fabricated for precision for all rafter-to-rafter and/or column-to-rafter connections, complete with connection bolt holes. Base Plates, Cap Plates, Splice Plates and Stiffeners, fabricate to sizes required, complete with all holes for connection of primary and secondary structural members; factory weld into place. Manufacturer will review all drawings & insure that structural members are designed to clear all other construction.

2.4 ENDWALL FRAMING: Precision cold-formed and/or shop-welded steel plate members consisting of rafters and columns fabricated for field-bolted assembly. Columns, Rafters, Splice Plates, Clips, Angles and Channels, factory fabricate to size required.

2.5 SECONDARY FRAMING: (1) Purlins - Manufacturer's standard 8" Z sections, roll formed from minimum (Fy) 55,000 PSI steel, punched for attachment. (2) Girts - 8" Z or channel sections of roll formed Fy 55,000 PSI steel, punched for attachment with 1/2" diameter bolts. (3) Eave Struts - 7 1/4" x 4" sections of cold formed minimum Fy 55,000 PSI steel, with vertical web to receive sidewall panels and two 1/2" diameter bolt attachments to rigid frame in factory-punched holes in column or bracket. (4) Roof Struts - provide as required, detailed and shown on final shop drawings, as required by design analysis, with attachment to top flange or rigid frame rafters by two 1/2" minimum size diameter bolts at each end of strut.

2.6 MASONRY WIND BEAMS: At all exterior walls with masonry above 7'-0" provide wind beams as designed by building manufacturer with a deflection criteria of L/360.

2.7 ROOF PANELS: The standing seam roof panel shall be precision roll-formed to provide 24" net coverage, 24-gauge, 50,000 PSI minimum yield steel. The panel edges shall join together to form a 3" high rib with high standing seam. The seam shall be a closed, double lock design with factory-applied sealant. The panel flats shall be embossed with cross ribs at 6" o.c. to minimize oil-can and flutter. The panel ends shall be factory-notched for end splicing (when required). Panels shall be longest length possible to minimize end splices. The panels shall be secured to the structure with concealed clips designed to accommodate the roof expansion/contraction and to provide a 1" insulation stand-off. The clip shall be made of 12 gauge steel, minimum yield of 36 ksi, coated with G90, meeting ASTM A446. Perimeter trim, start/finish panels, ridge cover and transition flashing shall be provided and shall be designed to accommodate the roof's expansion/contraction. Closures, sealants and fasteners shall be provided as required for a weathertight installation. Finish 0.5 oz. per sq. ft. aluminum-zinc alloy-coating "Galvalume".

2.8 WALL & SOFFIT PANELS: See specs 07610 Preformed Metal Wall & Soffit Panel

2.9 FASTENERS/WALL PANELS: Manufacturer's standard long-life coated #12 x 7/8" self-drilling carbon steel screws for liner panels and/or exterior single skin wall panels and #12-14 x 1 1/4" self- drilling carbon steel screws for exterior single skin wall panels utilizing blanket insulation up to 5" thick. Trim Fasteners standard plated and finish painted #8 x 5/8" self-drilling screws with 1/4" hex washer head. All exposed fastener heads will be factory colored to match color of panels, with sealing washer.

2.10 FASTENERS/STANDING SEAM ROOF PANELS: Panel Clips - manufacturer's standard sliding design to allow for unrestrained expansion and contraction movement of panels. Provide complete with 1/4-14 x 1 1/2" plated self-drilling fasteners at each clip. Exposed Fasteners for Eave, End Splice, Ridge Cover and Flashings standard #12-14 x 1 1/4" self-drilling screw with sealing washer; cap head and washer backer with 0.008" thick Type 302 stainless steel caps or zinc/aluminum alloy head. Painted or unpainted. Standing Seam Sealant - approved type nonshrinking, nondrying butyl-based sealant specifically formulated for factory application in standing seams and to allow roof panel assembly at temperatures from minus 10 deg F to 140 deg F.

2.11 WIND BRACING: Commercial grade steel rod bracing or K-frames located as determined by manufacturer, located so as to not conflict with other building elements. Preferred locations as shown in drawings. Provide complete with necessary slope washers, flat washers and adjusting nuts at each end. Clean components free of oil, dirt, loose scale and foreign matter.

2.12 WALL AND ROOF INSULATION: Wall and roof insulation systems to meet locally applicable energy codes. Manufacturer's standard noncombustible fiberglass blanket. Metal panel wall insulation to be R19 minimum, FSK faced with 3/16" thick closed-cell polyethylene foam thermal break. Roof insulation in concealed areas to be R30 minimum, two-layer R19+R19 system, "Energy Saver FP" system by Guardian Building Products, or another product determined to be equal by the Architect & approved in writing prior to submission of proposal; first layer installed parallel with the purlins, second layer positioned above and perpendicular to the purlins, with 1" minimum foam spacers installed at purlins to minimize conductive heat transfer from the purlins to the roof panels.

A. Thermal Design shall be an Approved Manufacturer.

B. Bay Insulation Systems shall be an Approved Manufacturer.

2.13 GUTTERS AND DOWNSPOUTS: Gutters for standing seam roof shall be suspended box sections of 26-gauge galvanized steel formed to match the configuration of the gable trim. Gutters shall be independent of the roof seal and shall be attached to the eave strut adapter by means of a gutter hanger. Gutter hangers shall be spaced at 4'-0" centers and attached to inside face of gutter and eave adapter by #12 self-drilling screws and to outer face of gutter by trim fasteners. Gutter sections shall be lapped 2" and sealed with sealant and then fastened with fasteners as specified on manufacturer's drawings. Gutter end closures shall be sealed with sealant and fastened with pop rivets as specified on manufacturer's drawings. Downspouts shall be 29-gauge galvanized factory-colored steel with a minimum cross section of 20 square inches. Downspouts shall be located according to design requirements as specified, or as shown. Downspouts shall be attached to a thimble installed in the gutter. Downspouts shall be attached to the wall panel using 26-gauge galvanized factory-colored steel straps on 10'-0" centers. A 75-degree elbow shall be provided at the base of all downspouts to direct the water flow away from the building. Finish, manufacturer's standard siliconized polyester system finish in color selected by Architect from all manufacturer's options including metallic colors.

2.14 ROOF JACKS AND PIPE FLASHING: Roof jack shall be a 26-gauge, Shell White steel cone factory installed and sealed to roof panel. Cone shall be made of same material. Stack or pipe penetration shall be at the centerline of a major corrugation of the roof panel. Pipe flashing shall consist of a molded rubber cone with an aluminum ring bonded to the base. Pipe flashing shall accommodate pipe diameter as specified and be capable of flashing penetration at any location of the roof panel. Flashing shall be sealed and fastened in accordance with manufacturer's drawings.

2.15 MANUFACTURER LOGOS: No manufacturer logos shall be visible on the building exterior or interior.

PART 3 - EXECUTION

3.1 ERECTION: Erection shall be accomplished by a trained, competent erector having experience in erecting metal buildings. Install all metal building system components in strict compliance with manufacturer's instructions shown on final shop drawings. Handle and store all materials to avoid damage and replace any damaged materials. Erector shall observe and follow recommendations of the Metal Building Manufacturers Association (MBMA) practice and procedures where applicable. Do not field cut or alter structural members without approval from manufacturer.

3.2 STRUCTURAL FRAMES: Erect true to line, level and plumb, brace and secure with temporary bracing in all directions as required. Level base plates and secure to anchor bolts to level plane with full bearing to foundation supporting structures.

3.3 BRACING: Install all permanent diagonal rod or angle bracing in roof and sidewalls as approved by manufacturer. Properly tighten rods to avoid excessive sag.

3.4 FRAMED OPENINGS: Securely attach to building structural framing members, square and plumb.

3.5 ROOFING AND SIDING PANELS: Install roof and canopy panels in such a manner to permit drainage to eaves of building, with panel ends square to eave. Install wall panels with vertical edges plumb. Arrange and nest sidelap joints away from prevailing winds when possible. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to grid lines. Protect factory finishes from mechanical damage or abrasions. Install approved type closures to exclude weather. Install weather seal under ridge cap. Flash and seal roof panels at eave, gable and perimeter of all openings through roof and elsewhere as required or shown on drawings. Flash and/or seal wall and liner panels at perimeter of all openings, under eaves and gable trims, along lower panel edges, and elsewhere as required or shown on drawings, as applicable. Remove all fastener or cutting shavings from roof and wall as erection is completed.

3.6 STANDING SEAM ROOF PANELS: Install panels with positive interlock between installation clips and standing seams in manner that will allow panels to support erection loads prior to closing of seams. Install concealed panel clips over top of roofing insulation along each standing seam at location and spacing determined by metal building manufacturer. Where panel end splices occur, nest panels with 3" end laps and install interlocking clamping plates and sealant. Make splice independent of structure to allow for free expansion and contraction movement of panels without stress on splice. Close standing seams to assure complete sealant engagement and to assure structural integrity of panel-to-panel and panel-to-clip connections. Use fasteners penetrating roof panel only at eaves and end splices. At these conditions, use fasteners in conjunction with clamping plates (with factory-punched holes to assure correct fastener placement) and approved type butyl sealant to assure positive watertight seals. Install ridge cover units of approved expansion joint design to accommodate expansion and contraction movement of roof panels without ponding at end splices.

3.7 WALL PANELS: Install wall panels on exterior side of metal framing with liner panels installed on building interior in locations shown on drawings. Align bottoms of panels to proper coverage and fasten with manufacturer's recommended and supplied fasteners. Cut and fasten flashing and trims with approved type fasteners. Install all fasteners with power tool having adequate torque and proper r.p.m. adjusted to seat fastener without damage to heads, washers or panels. Install panel sidelap away from prevailing wind or view direction when possible, maintaining proper lap without fastener dimpling or excessive overlap.

3.8 ACCESSORIES: Install gutters, downspouts, flashings, trim, ridge covers, roof curbs, pipe flashings, closure strips, roof jacks, and other accessories and sheet metal items in accordance with manufacturer's recommendations for positive attachment to building and provide a weathertight mounting.

3.9 THERMAL INSULATION: Install in accordance with manufacturer's recommended procedure, performed concurrently with installation of wall and roof panels. Install blankets straight and true. Fasten tabs together or lap and glue to provide complete vapor barrier. Place insulation with facing exposed to interior of building unless shown otherwise.

3.10 TOUCH-UP: Touch-up all abrasions, scratches, field welds or other damages in shop-primed or factory-finished painted surfaces consistent with shop primer or factory-finished painting.

3.11 TOLERANCES: Erect framing in accordance with AISC and manufacturer's specifications and instructions, except columns shall be plumbed with a tolerance of 1:300.

DIVISION 31 – EARTHWORK

31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS: Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY: This Section includes Soil treatment for termite control.

1.3 SUBMITTALS: Treatments and application instructions, including EPA-Registered Label. Product Certificates: Signed by manufacturers of termite control products certifying that treatments furnished comply with requirements. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.4 SOIL TREATMENT APPLICATION REPORT: After application of termiticide is completed, submit report for Owner's record information.

1.5 QUALITY ASSURANCE: A PCO who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment in jurisdiction where Project is located and who is experienced and has completed termite control treatment similar to that indicated for this Project and whose work has a record of successful in-service performance. Comply with all requirements of Texas “Structural Pest Control Board” & EPA.

1.6 COORDINATION: Coordinate soil treatment application with excavating, filling, and grading and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs, before construction.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in a soluble or emulsible, concentrated formulation that dilutes with water or foaming agent, and formulated to prevent termite infestation. Use only soil treatment solutions that are not harmful to plants. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to the product's EPA-Registered Label. Subject to compliance with requirements, provide Termidor SC, Dominion 2L or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION: Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of the soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparing substrate. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil and around foundations. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended by termiticide manufacturer. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute the treatment evenly. Apply under all building foundations on grade. Avoid

disturbance of treated soil after application. Keep off treated areas until completely dry. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions. Post warning signs in areas of application. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

DIVISION 32 – EXTERIOR IMPROVEMENTS

32 31 13 - CHAIN-LINK FENCES & GATES

PART 1 - GENERAL

1.1 DESCRIPTION: Furnish all labor, materials, tools, & equipment as required for all Chain-link fencing, as shown on the Drawings, specified herein, and as needed for a complete and proper installation.

1.2 RELATED DOCUMENTS: The drawings, General Conditions, Supplementary Conditions, and requirements of Division 1 apply to work of this section.

1.3 SUBMITTALS: Within 45 calendar days after the Contractor has received the Owner's Notice to Proceed, submit complete product information to the Architect for review.

PART 2 - PRODUCTS

2.1 FENCE FABRIC: "Chain-link" fabric to be hot dipped galvanized #9 gauge wire woven in a 2" mesh.

2.2 FRAME: Frame to be hot dipped galvanized pipe. Fittings to be malleable iron & hot dipped galvanized. Tension wire to be #7 hot dipped galvanized high carbon spring wire. Provide the following frame sizes:

A. End & corner posts 3" OD, sched 40;
B. Line posts to be 2" OD, sched 40;
C. Horizontal rails to be 1.625" OD sched 20;
D. Gate frame – see drawings.

2.3 GATES: Gates to have 2" OD frame, with hinges, catch stop hasp & padlock.

2.4 FENCE SLATS: Equal to Hoover Fence Co. "OptionLock Slats" Non-winged PVC Slats for Chain Link Fences.

2.5 OTHER MATERIALS: Furnish and install any supplementary materials, whether or not specifically indicated, required for a complete and proper installation, as selected by the Contractor subject to the acceptance of the Architect.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION: Space posts at 10' OC max & mount securely. Attach fabric to posts with bands at 14" OC & to rails & bottom wire at 24" OC. Install materials in accordance with manufacturer's instructions and approved submittals. Install materials in proper relation with adjacent construction and with uniform appearance.

3.3 DAMAGE/CLEANING: Restore or replace damaged components. Clean and protect from damage.

32 92 13 - HYDRO-MULCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Description. Provide and install temporary & permanent seeding for erosion control to all areas regraded by construction or demolition activities.

PART 2 - PRODUCTS

2.1 Topsoil. Imported topsoil shall be a fertile, loose loam, dark brown or black in color, and typical of cultivated topsoil available locally. It shall be reasonably free of subsoil, stones larger than 1" in diameter, earth clods, sticks, roots or other objectionable and extraneous matter of debris. The pH shall be between 5.0 and 7.5, and it shall have at least 3% to 5% organic material by dry volume. The Contractor is to provide reports from a testing agency verifying these requirements. The Seeding Contractor will be responsible for providing a weed-free final product, regardless of the topsoil source or provider.

2.2 Seed. Provide seed from the previous season's crop meeting the requirements of the Texas Seed Law, including the testing and labeling for pure live seed (PLS = Purity x Germination). Furnish seed of the designated species, in labeled unopened bags or containers to the Engineer before planting. Use within 12 mo. From the date of the analysis. When Buffalograss is specified, use seed that is treated with KNO3 (potassium nitrate) to overcome dormancy.

A. SEED MIXTURES

1. Permanent revegetation "Meadow Mix" equal to Native American Seed • Junction, Texas • 1-800 728-4043 • E-mail: info@seedsource.com

a. Plant 25% of designated area in "Comanche Mix" Item #1800, at a planting rate of 20 lbs. per acre, containing:

i Greenthread
ii Huisache Daisy
iii Indian Blanket
iv Lazy Daisy
v Prairie Verbena
vi Texas Bluebonnet
vii The perennial wildflowers can be planted in spring or fall.

b. Plant 75% of designated area in "Caliche Mix" Item #2860, at a planting rate of 15 lbs. per acre, containing:

i Blue Grama
ii Buffalograss
iii Green Sprangletop
iv Indiangrass
v Little Bluestem
vi Prairie Wildrye
vii Sand Lovegrass
viii Sideoats Grama
ix Sand Dropseed
x Texas Cupgrass
xi Cane Bluestem

xii Curly Mesquite
xiii Warm season native grass seeds germinate when soil temps are above 65º F. The best time to plant native grasses is late spring in normal rainfall years. However, successful plantings may be made up until 90 days before frost.

c. Permanent revegetation of periodically wet areas, such as detention ponds, plant "Drainfield Mix" Item #2861, at a Planting Rate of 30 lbs. per acre, containing:
i Big Bluestem
ii Cereal Rye Grain
iii Eastern Gamagrass
iv Green Sprangletop
v Prairie Wildrye
vi Switchgrass
vii Bushy Bluestem
viii White Tridens

d. October 15 - April 15 - Temporary Turf Only, "Cereal Rye Grain" Item #8050. For use as a nurse crop with native grasses, when planting on relatively level ground, a seeding rate of 25 lbs / acre of cereal rye grain to provide cool season winter vegetation. If the area is a highly erodible slope or in a waterway, a rate up to 100 lbs / acre to provide cool season, quick, short-term vegetation. Use full planting rates of other native seeds.

i Should project timing require the application of a temporary turf, it shall be followed during the April to October planting season with the permanent turf mixes as specified. The base bid shall include all permanent turf establishment, regardless of whether the temporary seeding is applied.

e. Grass seed for permanent & temporary revegetation shall be placed in all areas regraded by construction operations.

2.3 Fertilizer. Use fertilizer in conformance with TxDOT specifications.

2.4 Vegetative Watering. Use water that is clean and free of industrial wastes and other substances harmful to the growth of vegetation.

2.5 Mulch.

A. Straw or Hay Mulch. Use straw or hay mulch in conformance TxDOT specifications.

B. Cellulose Fiber Mulch. Use only cellulose fiber mulches that are on the approved list published in “Field Performance of Erosion Control Products,” available from the TxDOT Maintenance Division.

C. Submit 1 full set of manufacturer’s literature for the selected material. Keep mulch dry until applied. Do not use molded or rotted material.

2.6 Tacking Methods. Use a tacking agent applied in accordance with the manufacturer’s recommendations or a crimping method on all straw or hay mulch operations. Tacking agents must be approved before use, or specified on the plans.

PART 3 - EXECUTION

3.1 CONSTRUCTION. Cultivate the area to a depth of 4 in. before placing the seed unless otherwise directed. When performing permanent seeding after an established temporary seeding, cultivate the seedbed to a depth of 4 in. or mow the area before placement of the permanent seed. Plant the seed specified and mulch, if required, after the area has been completed to lines and grades as shown on the plans.

3.2 BROADCAST SEEDING. Distribute the seed or seed mixture uniformly over the areas shown on the plans using hand or mechanical distribution or hydro-seeding on top of the soil. When seed and water are to be distributed as a slurry during hydro-seeding, apply the mixture to the area to be seeded within 30 min. of placement of components in the

3.3 EQUIPMENT. Roll the planted area with a light roller or other suitable equipment. Roll sloped areas along the contour of the slopes.

3.4 STRAW OR HAY MULCH SEEDING. Plant seed according to TxDOT specifications, “Broadcast Seeding.” Immediately after planting the seed or seed mixture, apply straw or hay mulch uniformly over the seeded area. Apply straw mulch at 2 to 2.5 tons per acre. Apply hay mulch at 1.5 to 2 tons per acre. Use a tacking method over the mulched area.

3.5 CELLULOSE FIBER MULCH SEEDING. Plant seed according to TxDOT specifications Section 164.3.A, “Broadcast Seeding.” Immediately after planting the seed or seed mixture, apply cellulose fiber mulch uniformly over the seeded area at the following rates:

A. Sandy Soils with slopes of 3:1 or less—2500 lb. per acre.

B. Sandy Soils with slopes greater than 3:1—3000 lb. per acre.

C. Clay Soils with slopes of 3:1 or less—2000 lb. per acre.

D. Clay Soils with slopes greater than 3:1—2300 lb. per acre.

3.6 Cellulose fiber mulch rates are based on dry weight of mulch per acre. Mix cellulose fiber mulch and water to make a slurry and apply uniformly over the seeded area using suitable equipment.

3.7 DRILL SEEDING. Plant seed or seed mixture uniformly over the area shown on the plans at a depth of 1/4 to 1/3 in. using a pasture or rangeland type drill. Plant seed along the contour of the slopes.

3.8 STRAW OR HAY MULCHING. Apply straw or hay mulch uniformly over the area as indicated on the plans. Apply straw mulch at 2 to 2.5 tons per acre. Apply hay mulch at 1.5 to 2 tons per acre. Use a tacking method over the mulched area. Apply fertilizer in conformance with TxDOT specifications Article 166.3, “Construction.” Seed and fertilizer may be distributed simultaneously during “Broadcast Seeding” operations, provided each component is applied at the specified rate. When temporary and permanent seeding are both specified for the same area, apply half of the required fertilizer during the temporary seeding operation and the other half during the permanent seeding operation. Water the seeded areas at the rates and frequencies as shown on the plans or as directed.

FOOD SERVICE SECTIONS

COUNIHAN & ASSOCIATES

Consultants & Designers to the Hospitality & Food Service Industry

BRADY I.S.D. CULINARY ARTS KITCHEN AND SMALLWARES

Brady, Texas

General and Detailed Food Service Equipment and Smallwares Specifications

Section 11400

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PART 11400 - FOOD SERVICE EQUIPMENT SPECIFICATIONS:

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PART 11400 FOOD SERVICE EQUIPMENT SPECIFICATIONS

SECTION 11400.1 **SCOPE OF WORK:**

The work covered by this Section includes the furnishing of all labor, materials, accessories, and special services necessary to complete the work specified herein and where shown and scheduled on the Drawings.

SECTION 11400.1.01 **WORK INCLUDED:**

A. Provide and install all Food Service Equipment at the food service facility, whether mobile or fixed.
B. Fabricate and install all plastic laminate covered wood and stainless steel casework (cabinets, tables, sinks, preparation areas, shelves, etc.,) including fixtures and fittings, piping and connections.
C. Locate and provide to the General Contractor or install all hidden (in floor or in wall) supports, brackets, or fittings.
D. Installation excluding connections to utilities. It is the responsibility of the Food Service Contractor to verify that all utility services are located in the proper locations for the equipment being supplied.
E. Work shall include the provision for setting, testing, and calibration, starting-up, demonstration, warranting of all food service items to the satisfaction of the Owners.
F. The Kitchen Equipment Contractor shall obtain and pay for all necessary permits and licenses required and necessary for the performance of the work, and shall post all notices required by law, comply with all laws, ordinances, and regulations bearing on the conduct of the work as drawn and specified.
G. On any work upon which an inspection certificate by local authorities, State Fire Marshall, or any other governing body is required, such inspection or certificates shall be obtained by the Kitchen Equipment Contractor and shall be paid for by him.
H. All plumbing, electrical, and ventilation work required to connect with equipment will be done by other contractors unless specifically called for in “Itemized Specifications”. The work to be done by these other contractors shall include roughing-in to points indicated on mechanical plans, and the final connections from the roughing-in point to the various pieces of equipment requiring such connections, and the supplying of all necessary material and labor for this work except as hereinafter noted.
I. Refrigeration work shall be handled by the Kitchen Equipment Contractor except for electrical and plumbing connections to compressors, blower coils, controls, etc. These final connections will be made by other contractors.
J. All traps, grease traps, line strainers, tail pieces, valves, stops, shut-offs, and fittings necessary will be furnished and installed under mechanical contract by others, unless specifically called for under each item. All steam traps, line strainers, valves, shut-offs and fittings necessary will be furnished and installed under mechanical contract by others, unless otherwise specified in “Itemized Specifications”.
K. All line and disconnect switches, safety cut-offs, control panels, fuse boxes or other electrical controls, fittings, and connections will be furnished and Installed by others. Starting switches are to be provided by the Kitchen Equipment Contractor as specified under “General Specifications”. Those starting switches furnished loose as standardized by Food Service

Equipment Manufacturers (other than fabricated items) shall be mounted and wired complete under Electrical Contract.

L. Any sleeves or conduit required for refrigeration, carbonated water, or CO2 tubing will be furnished and installed under electrical or mechanical contract by others.

M. Necessary flues and/or vents of size and capacity required to operate fixtures specified, together with final connection between roughed-in vent openings and fixtures, will be furnished and installed by other contractors, unless otherwise specified in "Itemized Specifications".

N. Unless specifically called for in the following specifications, ventilating fans and all duct work between same and fixtures, and from same to discharge opening in building, will be furnished and installed by Mechanical Contractor.

O. Water inlets shall be located above the positive water level to prevent siphoning of liquids into the potable water system. Wherever conditions shall require submerged inlet, suitable approved type of check valve and vacuum breaker shall be placed on the fixture to form part of same to prevent siphoning. If exposed and design dictates, piping, and fittings shall be chrome plated. These vacuum breakers as required to be provided by Kitchen Equipment Contractor.

SECTION 11400.1.02 **RELATED WORK**

A. Section 01010 - Summary of Work: Sequence of Work
B. Section 01030 - Administration Procedures
C. Section 01060 - Regulating Requirements
D. Section 03300 - Cast in Place Concrete: Recessed Concrete Slab
E. Section 07900 - Sealants
F. Division 15 - Mechanical: Mechanical services and connections to equipment
G. Division 16 - Electrical: Electrical services and connections to equipment

SECTION 11400.1.03 **REFERENCES:**

A. ANSI/ASTM A167 - Stainless and Heat-resisting Chromium Nickel Steel Plate, Sheet and Strip
B. ANSI/AWS D1.1 - Structural Welding Code
C. ASTM A446 - Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality
D. FS DD-G-451 - Glass, Float or Plate, Sheet, Figured (Flat for Glazing, Mirrors, and Other Uses.)
E. FS-DD-G-1403 - Glass, Plate (Float), Sheet Figured, and Spandrel (Heat Strengthened and Fully Tempered).

SECTION 11400.1.04 **REGULATORY REQUIREMENTS:**

Fabricator: Companies specializing in the manufacture of commercial food service equipment with minimum ten years' experience.

SECTION 11400.1.05 **REGULATORY REQUIREMENTS:**

A. Cooler and Freezer Units: Listed by Underwriters Laboratories, Inc. (UL).
B. Electrical Wiring and Components and Self-contained Refrigeration Systems: Conform to Underwriters' Laboratories, Inc. (UL) standards.
C. Exhaust Hoods: NFPA-96, Exhaust hood is specified and bid with the mechanical sections and applicable equipment.

D. Fabricated Equipment: National Sanitation Foundation (NSF) - Food Service Equipment Standards.
E. Conform to requirements of National Electric Manufacturers Association (NEMA) and the Underwriters' Laboratories, Inc. (UL).
F. Conform to the requirements of the Texas Department of Health.
G. Conform to the requirements of the American Gas Association (AGA).
H. Conform to the requirements of the American Society of Mechanical Engineers (ASME).
I. Conform to applicable section(s) of the Southern Building Code Congress International.

SECTION 11400.1.06 **SUBMITTALS:**

A. Kitchen Equipment Contractor shall prepare detailed shop drawings, prepared at a scale of 3/4" to the foot, plus necessary cross sections at a scale of 1-1/2" to the foot, showing complete detail of each item of specially fabricated equipment.
B. *Shop Drawings:* Each manufacturer whose work requires fabrication and/or erection drawings and the preparation of adjacent work by others to accommodate special equipment shall prepare and submit shop drawings to the Architect/Owner for review prior to fabrication. Complete shop drawings of all equipment and data sheets from manufacturers shall be assembled in loose-leaf binders and six (6) copies shall be submitted to Architect/Owner. Refer to Division 1 of these Specifications for requirements.
C. The Kitchen Equipment Contractor shall check all measurements at the building site and be responsible for same. Measurements shown on drawing accompanying these specifications are approximate and are for establishing purposes only. Where necessary, KEC shall confer with the Owner or General Contractor and the Title Contractor to coordinate and establish such finished dimensions as are required and furnish drawings to confirm these established dimensions wherever necessary. At the time of checking measurements, the KEC shall carefully examine the spaces and existing conditions and report to the Owner any work performed by others or planned by others which prevent him from execution of his work as required under the contract. The KEC shall obtain the Owner's final decision and instructions before proceeding with the portion of his detailed drawing.
D. Should the contract for food service equipment be awarded after the mechanical services have been roughed-in, the Kitchen Equipment Contractor shall carefully measure the locations of all floor and wall penetrations and existing conditions and indicate them; and provide for them on the shop drawings and final mechanical plans. If the inspection reveals that any of these existing conditions seriously interfere with the execution of the work as required under this Contract, the K.E.C. is to report these conditions to the Consultant and await a decision and instruction before proceeding with that portion of the detailed drawings.
E. Submit manufacturer's installation instructions under provisions of Section 01400.

SECTION 11400.1.07 **MATERIAL AND WORKMANSHIP:**

A. Unless otherwise specified or shown on drawings, all material shall be new, of best quality, perfect, and without flaws. Material shall be delivered and maintained on job, in an undamaged condition. Samples of materials shall be available should the Owner request it.
B. All workmanship shall be the best of their respective kind, equal to the standards of manufacture used by all first-class equipment manufacturers. All labor shall be performed in a thorough, workmanlike manner by qualified, efficient, and skilled mechanics of the trades involved.

C. All items of standard equipment shall be the latest model at time of delivery.

SECTION 11400.1.08 **SANITARY CONSTRUCTION:**

All fabricated equipment is to be constructed in full compliance with the Local and State Public Health Regulations in which the installation is to be made.

SECTION 11400.1.09 **OPERATION AND MAINTENANCE DATA:**

A. Submit operation and maintenance data on all equipment supplied under provisions of Section 01700.
B. Include data on care of finished surfaces.
C. Submit a list of factory authorized Repair Agencies for all equipment

SECTION 11400.1.10 **DELIVERY, STORAGE, AND HANDLING:**

A. Deliver products to site under provisions of Section 01600.
B. Store products under provisions of Section 01600.
C. Store products clear of floor in manner to prevent warping and damage.
D. Coordinate size of access and route to place of installation.

SECTION 11400.1.11 **WARRANTY:**

A. Provide manufacturer's warranty.
B. Warranty: Include coverage of scheduled equipment, including disconnection of defective unit, and connection of replacement unit.
C. All compressors shall be furnished by the K.E.C. (kitchen equipment contractor) with extended four-year full-replacement warranties for a total of five years with an initial one-year contractor's warranty.
D. Kitchen Equipment Contractor shall make suitable arrangements with local approved service and repair agencies for the servicing and maintenance of the equipment should malfunctions occur within factory warranty period. Upon completion of the installation and prior to the final payment, the Contractor shall furnish the Owner with a list of the local agencies to be called in the event malfunctions occur for any equipment supplied.

SECTION 11400.2 **FABRICATORS/DEALERS/CONTRACTORS – PRE-APPROVED:**

PRE-APPROVED EQUIPMENT DEALERS/SUPPLIERS:

Mission Restaurant Supply
6500 No. Lamar St.
Austin, Texas 78752
(512) 389-1705
Attn: Bruce Walker
Email: brucew@missionrs.com
https://www.missionrs.com/

1st Choice Restaurant Equipment & Supply, LLC
Attn: Don Hudspeth, Project Manager

6108 HWY 290 West
Austin, TX 78735
Cell: 210-589-5690
Fax: 512-233-0686
Email: don@1stchoicecompanies.com

NOLA Restaurant Supply & Design
Attn: Will Alexander
234 Harbor Circle
New Orleans, LA 70126
P: 504.834.1521
F: 504.218.4207
www.NOLArestaurantSupply.com

Trimark Food Service Equipment
R. W. Smith
1-800-942-1101
http://www.rwsmithco.com/
http://www.trimarkusa.com/

PASCO, Inc.
6465 Chase Oaks Blvd.
Llano, TX 75023
Attn: David Eberhardt
Office: 972-596-3350
Cell: 214-686-6204
Email: deberhardt@pascoinc.net

PRE-APPROVED EQUIPMENT CUSTOM FABRICATORS:

CounterCraft – for Custom Counter Fabrication
7007 Stearns Houston, Texas 77021
rickp@countercraftinc.com
832-319-7455
Attn: Rick Perez or Lloyd Hartsfield
http://www.countercraftinc.com/

Texas Sheet Metal – for Custom SS and Millwork Fabrication only
P.O. Box 830105
San Antonio, Texas 78283-0105
(210) 222-8655
Attn: Ronnie Key

http://www.texassheetmetal.biz/

Master Fabricators (Cirilo Counters) – for Custom Counter Fabrication
Houston, Texas
ESource for Quotes: quotes@esequip.com
214-614-0215
Attn: Cindy Bennett
832-294-8103
http://www.masterfabricators.com/

Eagle Group – for Custom SS Fabrication only
Attn: Glenn Dorris
100 Industrial Boulevard
Clayton, DE 19938
(302) 653-3000
eaglegrp.com

Aero Manufacturing – for Custom SS Fabrication only
https://www.aeromfg.com/
ESource for Quotes: quotes@esequip.com
214-614-0215
Attn: Cindy Bennett

IMC Teddy – for Custom SS Fabrication only
http://www.imcteddy.com/
EPI for Quotes
Attn: Doug Durrwachter
(817) 552-5540
1905 Stone Myers Pkwy.
Grapevine, TX 76051
Or Suzanne Meno, IMC Teddy Managing Director
862-579-9183

SECTION 11400.2.01 **ALL FABRICATORS/DEALERS/CONTRACTORS:**
To be accepted as a bidder, contractor shall be approved by the Food Service Consultant and/or the Owner prior to bidding.

SECTION 11400.3.01 **PRODUCTS**

SECTION 11400.3.02 **EQUIPMENT:**

A. Refer to schedule at end of this Section.
B. Provide rough-in hardware, supports and connections, attachment devices, closure trim, and accessories.

SECTION 11400.3.03

MATERIALS:

A. Sheet Steel: ASTM A446; 1.25 oz./sq. ft. galvanized coating.
B. All stainless steel shall be the minimum or heavier than the United States standard gauge 18-8, type 302, not over .012% maximum carbon, No.4 finish except where otherwise specified. All welds shall be ground smooth and polished to a No.4 finish, except where specified otherwise.
C. Glass: 3/16-inch float conforming to FS DD-G-451; tempered conforming to FS DD-G-1403; laminated; exposed edges ground; cut or drilled to receive hardware.
D. Finish Hardware: Manufacturer's standard
E. Black Iron (BI) or ferrous metals used shall be minimum 16 GA., fully welded at all joints and seams, and properly insulated as required by applicable codes, and to meet the requirements of NFPA Bulletin 96, current issue.
F. Structural Steel shall consist of angles, channels, bands, bars, straps, or other shapes, ductile in quality and free of corrosion, runs, checks, and crack, and surface defects. Members shall be galvanized.
G. White metal (castings and components) shall consist of corrosion-resistant metal containing not less than 30% nickel. All castings shall be rough ground, polished, and buffed to a bright luster, free from all pits, burrs, or imperfections.
H. Work Surfaces: Stainless Steel on all metal casework and plastic laminate on all plastic laminate covered wood casework.
I. Fittings: Sink drains with crumb cup and waste fittings, and faucets.
J. Service Outlet Covers and Escutcheons: Stainless Steel
K. Sealants: As required by manufacturer.
L. <u>GENERAL CONSTRUCTION:</u>
    1. All items of specially fabricated equipment must be by one manufacturer acceptable to the Owner.
    2. All work must be done in an approved workmanlike manner to the complete satisfaction of the Owner.
    3. All galvanized iron shall be Armco or equal. Framework of galvanized iron shall be welded construction. All welds shall be smooth, and where galvanizing has burned off the weld shall be touched up with a high-grade aluminum paint.
    4. All rolls shall be a minimum of 5/8" radius, except as detailed to the contrary, with corners bull nosed, ground and polished.
    5. All seams and joints shall be welded as the nature of the material used may require. Welds to be ground smooth and polished to match the original finish. Materials 18-gauge or heavier shall be welded.
    6. Field joints in stainless steel tops, etc., where required due to limitations of sheet sizes, equipment sizes, or installation requirements, shall be made sanitary tight and without open seams by means of welding, or if detailed or specified, by properly designed draw fastening, trim strip, or commercial joint material to suit the purpose required.
    7. Butt joints made by riveting straps under seams and then filled with solder will not be accepted.

8. Ends of all fixtures, splash backs, shelves, etc., shall be filled by forming the metal or welded sections, if necessary, to finish entire rear of fixtures, etc. flush to walls or adjoining fixtures.
9. All components of custom fixtures shall be fabricated of materials shown below, unless otherwise indicated:
    a. Metal table tops: 14-gauge stainless steel.
    b. Sinks, drain boards, back splash: 14-gauge stainless steel, No.4 finish, drain board shall be sound deadened.
    c. Elevated shelves: 14-gauge stainless steel, No.4 finish
    d. Under shelves: 14-gauge stainless steel, No.4 finish
    e. Glass rack shelves: 14-gauge stainless steel, No.4 finish
    f. Body, exposed: 14-gauge stainless steel, No.4 finish
    g. Body unexposed: 20-gauge galvanized iron, painted gray or aluminum
    h. Gussets: Klein Hardware, No.481-58
    i. Legs/Crossrails: 1-5/8" OD 16-gauge stainless steel tubing
    j. Feet: Stainless steel adjustable
    k. Drawer Liners: 20-gauge stainless steel
    l. Drawer Face: 14-gauge stainless steel, No.4 finish
    m. Drawer Slides: stainless steel, heavy duty, extension, Klein Hardware or Grant.
    n. Drawer housing: 20-gauge stainless steel
    o. Drip Troughs: 18-gauge stainless steel, No.4 finish with ant- splash grid.
    p. Top Braces: 14-gauge galvanized from channels
    q. Refrigerated fixture exterior: Manufacturer's Standard Specification
    r. Refrigerated fixture interior: Manufacturer's Standard Specification
10. TABLE TOPS:
    a. All metal tops shall be one-piece welded construction, reinforced on the underside with closed galvanized steel hat sections, secured in place by stud bolts, welded to top so tops can support heavy weights without deflections. All free edges of tops to be turned down 90 degrees with a 2" flange and made with rounded corners.
    b. Underside of all tops to be sound deadened with 12-gauge galvanized hat channels running full length of top with vinyl cushion between channels and underside of top.
11. LEGS AND CROSSRAILS: All equipment legs shall be 1-5/8", 16-gauge stainless steel tubing unless otherwise noted. All welds at crossrails shall be ground smooth and finished. Bottom of legs at floor shall be fitted with sanitary stainless steel bullet feet with not less than 3/4" adjustment. Legs shall be fastened to equipment as follows:
    a. To sinks by means of enclosed gussets welded to 14-gauge stainless steel triangular support pads tack welded in place to sink bottom. Gussets shall be completely enclosed sanitary type, stainless steel, reinforced with bushings, and have set screws for securing legs.
    b. The metal table tops and dish tables with enclosed gussets (as above) which shall be welded to galvanized steel hat sections of 14-gauge. Bracing shall be secured by stud bolts welded to underside of tops. Hat sections to be completely closed on ends; stainless steel on exposed ends.

c. Enclosed gussets shall be minimum 3” diameter at top and continuously welded to frame members or sink bottom support pads.

12. DRAWERS:
    a. All drawer fronts shall be fabricated of 14-gauge stainless steel. Drawer shall consist of a removable 15 x 20 x 5 die-drawn coved liner of 20-gauge stainless steel set into a stainless-steel frame mounted on stainless steel interlocking channel supports with large size quiet ball bearing wheel suspension and stops to prevent drawer from being pulled out of fixtures.
    b. Support slides shall be constructed so that drawers may be pulled out a minimum of two-thirds of its length and support heavy loads without deflection. Drawer liners shall be easily removable.
13. SHELVES:
    a. Under shelves: on open base table construct of 18-gauge stainless steel, No.4 finish for dish tables and 14-gauge stainless steel, No.4 finish for work tables, unless otherwise noted.
    b. Elevated shelves: construct shelves of 14-gauge stainless steel, No.4 finish. Front and ends to be turned down 1-1/2”, then back 1/2” on 45-degree angle.
14. SINKS AND DRAINBOARDS:
    a. Unless otherwise noted, all sinks and drain boards shall be 14-gauge stainless steel, No.4 finish. Sound deaden underside of drain boards Schnee-Butyl 1/2” rope applied between top and framing.
    b. Sink compartments shall have fully coved vertical and horizontal interior corners. Bottom of each compartment shall have four (4) radial die-stamped grooves pitched to center drain. Partition for compartment sinks shall be of same material, double thickness and continuously welded where sheets join at the top.
    c. Finish top sink edges at front and ends with a 1-1/2” die formed integral semi-roll trim.
    d. Across the back of all sinks, unless specified there shall be an 8” high integral splash back, turned back 1-1/4” on 45-degree angle, then 1” flat to wall and down 3/4”. Secure to wall with 12” long “Z” clips.
    e. All dish tables, drain tables, splash backs, and turned-up edges shall have radius bends 5/8” or larger in all horizontal and vertical corners, coved at intersections.
15. DRAIN FITTINGS:
    a. Furnish and install Klein Hardware No. SS-489 basket drain in all die drawn inset-type sinks, unless specified or detailed otherwise.
    b. Furnish T&S Brass and Bronze Works, Inc. or Fisher faucet on all sinks, bain maries, water stations and other fixtures except as noted otherwise. See drawings for types and sizes specified. All faucets to be furnished complete with shank and coupling nuts for mounting faucet to fixtures.
16. HARDWARE:
    a. All hardware shall be solid materials. Handle and wearing parts to be cast brass, chrome plated except where specified to the contrary. Hardware shall be locking-type as specified.

b. All hardware shall be identified with manufacturer's name and number so that broken or non-working parts may be replaced. Contractor shall submit samples for approval, where required.

17. CASTERS & FASTENERS:
    a. Casters shall be heavy-duty type, ball bearing, disc wheel with replaceable grease-proof rubber or neoprene tires. Wheel shall be 5" diameter, minimum width of tire tread 1-3/16"; minimum capacity per caster 250 pounds. Provide grease fittings, tread guards, and polished plate finish. Where specified, provide with wheel locking device.
    b. No exposed screw or bolt heads will be permitted on fixtures or installation materials. Rivets, if specified, shall be countersunk flush and of the same material as the pieces joined together.
18. HEATING EQUIPMENT:
    a. Wherever gas, electric, or steam heating equipment or thermostat controls for such equipment are used, it shall be complete and of materials, size, or rating as specified within the equipment item or detail.
    b. Electric appliance or heating element circuits of 120 volts shall not exceed 1600 watts as noted.
    c. All steam heated, custom fabricated equipment shall be a self-contained assembly complete with control valve in an accessible position in recessed panels where indicated.
19. SWITCHES, CONTROLS, AND ELECTRICAL WORK:
    a. All internal wiring for fabricated equipment, including all electrical devices, wiring controls, switches, etc. built into or forming an integral part of these items, shall be furnished and installed by the Kitchen Equipment Contractor, in his factory, or at the building site with all items complete to junction boxes as required. Final connections of the equipment shall be made by the Electrical Contractor from the equipment to the junction boxes.
    b. Provide standard 3-prong plugs to fit "U" slot grounding type receptacles for all equipment items powered by plugging into 110-120 volts, single phase AC. Also, provide suitable length 3-wire cord for the equipment.
20. CONVENIENCE OUTLETS: Where receptacles are shown in fabricated fixtures, the Equipment Contractor shall supply cut out and box set integrally in place with conduit extended from box to position accessible to the electrical. (Wiring, receptacle and stainless steel cover plate will be furnished and installed by Electrical Contractor.)
21. QUIETNESS OF OPERATION: Quietness of operation of all food service equipment is a requirement. The contractor will be required to remove or repair any equipment which produces objectionable noise.
22. THERMOMETERS: All refrigerated compartments, fabricated and standard, shall be equipped with dial-type thermometers with chrome plate bezels. Thermometers shall be adjustable and shall be calibrated after installation.
23. EXPANSION VALVES: All standard reach-in refrigerators and freezers for remote refrigeration systems shall be complete with thermostatic expansion valves at the evaporator.
24. REFRIGERATION HARDWARE: Refrigeration hardware for standard and fabricated refrigerator compartments shall be heavy duty components. Hinges shall be self-

closing. Latching to be magnetic edge mount type, unless specified or detailed to the contrary.

25. LOCKS: All doors for reach-in refrigerated and frozen compartments, both fabricated and standard items, shall be fitted with cylinder locking type latches and shall be provided with master keys. Doors and drawers of fabricated items shall be fitted with locks and master keyed, separate from refrigerated compartments.
26. TRIMMING AND SEALING EQUIPMENT:
    a. Space between all units to walls, ceiling, floors and adjoining units not portable and with enclosed bodies, shall be completely sealed against entrance of food particles or vermin by means of trim strips, welding or soldering or commercial joint material as suited to the nature of the equipment and in compliance with local Health Department regulations.
    b. Ends of all hollow sections to be closed.
    c. Enclosed fixtures without legs not mounted on masonry bases shall be sealed water tight to floor, except when specified to be portable. (Refrigerators, ice cream cabinets, ovens, etc.)

SECTION 11400.3.04 **FABRICATION GENERAL:**

A. Stainless Steel Fastenings and Fittings: Bolts and screws with countersunk flat heads should be used. Use concealed fastenings where possible.
B. Form edges smooth. Fabricate sheet material for work surfaces, facings, shelves, and drain boards of straight lengths in one continuous sheet whenever over 12 ft. in length.
C. Fix leg-mounted units by doweling to floor with 1/4” stainless steel pins, where vibration or oscillation is anticipated.
D. Provide legs of adjustable, stainless steel feet. Fasten legs to equipment securely and rigidly.
E. Install rubber or nylon button feet or other protective device on bearing surface of any item positioned on a finished surface.
F. Isolate rotating or reciprocating machinery to prevent noise and vibration.
G. Provide indirect drain piping from equipment to terminate over nearest waste receptor.
H. Provide accommodation for site installation of other services or equipment.
I. Grind welds of stainless steel smooth and flush; polish to match adjacent surfaces.
J. Cut and drill components for service outlets and fixtures.
K. Shop assemble work where possible
L. Unless otherwise approved, the work as included under this heading of the specifications shall conform to all applicable current Standards and Revisions established by the National Sanitation Foundation (NSF), Ann Arbor, Michigan.

SECTION 11400.3.05 **FABRICATION, HARD SURFACE**: Reinforce frame support system and surfaces so that surfaces may safely support a load of 200# lbs. concentrated on one square foot in any area on surface with no indentation showing on surface and with permanent set not exceeding 0.005 inches.

SECTION 11400.3.06 **SERVICE ACCESSORIES:**

A. Provide control switch or starter on each motor-driven appliance or heating element in accordance with UL requirements.
B. Provide internal wiring for equipment, including electrical devices, wiring controls, and switches to a common junction box.

C. Provide suitable length of three-wire cord with plugs to match building receptacles.
D. Provide lamps for fixtures in equipment.
E. Provide equipment with connection terminals so that connections of plumbing, gas, steam, electrical, ventilation and refrigeration services can be made. Where receptacles are specified for custom equipment, supply cut outs and outlet boxes set in place accessible for connections of electrical work.

SECTION 11400.3.07 FINISHES:

A. Metal (Except Stainless Steel): Degrease and phosphate etch followed by primer and a minimum of two coats of epoxy enamel, as selected by Architect or Owner.
B. Stainless Steel shall be manufacturer's standard SS finish and for fabricated items shall be polished and grained to a #4 commercial finish. Polishing grain shall run in the same direction on equipment wherever possible. Polishing grain shall be mitered on intersecting planes. All sheets shall be deburred before working, and all equipment shall exhibit no burrs upon installation.
C. Exposed, exterior galvanized surfaces shall not be painted. Recoat any areas where galvanized has been removed or damaged in working with ARMCO Zinc-Grip, self-priming galvanized lacquer. Remove all machine oils or foreign material before recoating.
D. Shop shall pre-finish all components.
E. Manufacturer's standard finish for equipment: refer to equipment listing at the end of this specification.

SECTION 11400.4 EXECUTIONS

SECTION 11400.4.01 INSPECTION:

A. All sizes given or derived on drawings are to be as accurate as can be determined prior to construction. The Food Service Contractor shall check all dimensions in the field that affect the work. He shall not order any items requiring critical installation clearances or fitting before verifying field dimensions. Source water pressure, temperature, gas service, and site voltage shall all be verified by the Food Service Contractor prior to commencement of work under this section. Where obstructions are found to occur the Food Service Contractor shall accommodate the structure of the building in for the equipment.
B. Verify ventilation outlets, service connections, and supports are correct and in required location.
C. The Owner or Consultant shall have free access to the Kitchen Equipment Contractor's shop during the construction of this equipment for the purpose of making inspections to see that plans, specifications and detail drawings are being adhered to carefully. Kitchen Equipment Contractor shall correct any errors found during these inspections to the extent and within the scope of the plans, specifications and detail drawings.
D. Material delivered to the site will be carefully inspected by the Owner as to conforming to plans and specifications. The Kitchen Equipment Contractor shall, within twenty-four hours after receiving written notice, proceed to remove from the grounds or building all materials, fixtures, or apparatus condemned by the Owner, whether the same shall be reworked or taken down and remove all portions of the work which the Owner shall deem as failing to conform to the drawings and specifications and to the conditions of the contract.

E. The Owner shall have the right to order the work wholly or partially stopped until the objectionable work, materials, fixtures, or apparatus are removed or to declare the contract forfeited for non-performance or not being executed according to the intent or meaning of the drawings and specifications.
F. All fabricated equipment shall be subject to test as to gauge of material upon Owner's request. This testing shall be at the Kitchen Equipment Contractor's expense.
G. INSURANCE: See Article 1.1 of the Supplementary Conditions for insurance requirements.
H. ROYALTIES AND PATENTS:
   1. The Kitchen Equipment Contractor shall pay all royalties and license fees.
   2. The Kitchen Equipment Contractor hereby covenants and agrees to save the Owner harmless and indemnify the Owner from the payment of any royalties, damages, losses, or expenses for suits, claims or otherwise, resulting for alleged infringement of patents, materials and methods used in the fabrication of this equipment.
I. ACCESS, AUTHORITY, AND STOPPAGE:
   1. The work shall be available for inspection at any time by representatives of the Owner.
   2. All materials and work not in conformity with the plans and specifications shall be subject to rejection. Owner shall be the sole judge of compliance with the plans and specifications.
   3. All defective work or materials shall be immediately replaced to conform to the plans and specifications.
   4. Consultant shall have the right to order the work of the Contractor or any sub-contractor wholly or partially stopped if, in their judgment, the materials furnished or the work being done is not in strict accordance with the provisions and specifications, or until any objectionable man or material is removed from the premises; and shall have the right to declare the contract forfeited for non-performance when not being executed according to the intent and meaning of the contract, plans and specifications.

SECTION 11400.4.02 **INSTALLATION:**

A. Use anchoring devices appropriate for equipment and expected usage.
B. Install items in accordance with manufacturer's instructions under provisions of section 01400.
C. Insulate to prevent electrolysis between dissimilar metals. Provide sealant to achieve clean joint without crevices.
D. Weld and grind joints in stainless steel work tight, without open seams, where necessary due to limitations of sheet sizes or installation requirements.
E. Sequence installation and erection to ensure mechanical and electrical connections are achieved in an orderly and expeditious manner.
F. Cut, fit, and patch where necessary. Coordinate work with others.
G. Cut and drill tops, backs or other elements for service outlets, fixtures and fittings.
H. Provide cutting and patching of items of this Section required for the installation of services of equipment.

SECTION 11400.4.03 **MECHANICAL/ELECTRICAL SERVICE:**

A. Furnish equipment completely inter wired for service to a single point of connection where indicated. Fabricated items shall feature service extended to junction boxes mounted on equipment bodies.
B. Final connection of all equipment to filled stubs shall be by Other Contractor, including all materials to do so.
C. Electrical Contractor to coordinate cords and caps for plug-in devices.
D. All Electrically heated equipment shall be provided with pilot lights, thermostats and junction boxes for hook-up. Elements shall be accessible for replacement and readily available.
E. All wiring shall be concealed, and only rigid conduit shall be used.
F. Any cover plated shall match the finish to which they are secured; All switches and controls shall be easily identified, and multiple controls shall have engraved nameplates adhesive-attached thereto, for identification. Submit a sample of the intended material for approval.
G. Water inlets shall be located above the positive water level in all areas. Wherever a submerged inlet can occur, provide an approved vacuum breaker or back flow preventer.
H. Provide suitable pipe slots through equipment for placement and conducting of services without cutting of equipment.
I. Final connection of all plumbing services shall be by the Plumbing Contractor.
J. All horizontal piping shall be kept at the highest level to facilitate cleaning. Extend from rough-ins to point of connection after equipment is set in place.
K. All steamer drain lines shall be metallic for the first 15'-0" regardless of any other specification, to withstand high-temperature wastes.

SECTION 11400.4.04 **ADJUSTING AND CLEANING:**

A. Adjust equipment and apparatus to ensure proper working order and conditions.
B. Remove masking or protective covering from stainless steel and other finished surfaces.
C. Remove and replace equipment which creates noise or vibration.
D. Wash and clean equipment thoroughly.
E. Polish glass, plastic, hardware and accessories, fixtures, and fittings.

SECTION 11400.4.05 **DEMONSTRATION AND TESTING:**

A. The Food Service Contractor shall start-up all equipment, regulate, calibrate, demonstrate, or test all items, and generally evidence to the Owner(s) satisfaction that the equipment is proper, functioning, and as specified (unless otherwise specified). He shall order and pay for any tests by municipal or regulatory authorities who question the suitability of equipment provisions under their jurisdiction. Final cleaning and polishing prior to placing in service shall be by the Owner.
B. At completion of work, provide qualified and trained personnel to demonstrate operation of each item of equipment and instruct Owner in operating procedures and maintenance.
C. Individual performing demonstration shall be fully knowledgeable of all operating and service aspects of equipment.
D. After all utility connections to the equipment are made by other contractors, the KEC shall conduct the final test of equipment in the presence of the Owner, or his duly authorized representative.
E. Kitchen Equipment Contractor shall furnish two (2) sets of dimensional prints, data sheets, spare parts lists, and operating instructions, for each piece of mechanical equipment; each set to be bound in a hard cover.

F. Before final inspection by Owner, the Kitchen Equipment Contractor shall remove protective covering from his work and give all parts of his equipment a thorough cleaning and servicing, leaving all items free from defects.

SECTION 11400.5.01 EQUIPMENT SPECIFICATIONS - DETAILED:

SECTION 11400.5.01 **EQUIPMENT SPECIFICATIONS – DETAILED (BY ITEM):**

Item #1 **Provide (1) Air Door, Berner, Model #ARC12-1036A:**
All white interior installed air door. Air door will be standard equipment, 120/60/single phase electrical, 3.4 Amps. K.E.C. will mount air door inside above rear door (see kitchen plan for exact location). NSF and UL listed. Air door to be supplied with plunger type actuator that shall energize air door when door is opened and turn off the air curtain when door is closed. Provide with adjustable mounting bracket. Electrical contractor to hook up air door to start, as door is opened, see installation details. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Electrical connection by General Contractor. Refer to Drawings for location.
(Equal Alternate Manufacturer [must match specification]: Mars)

Item #2 **Provide (1) Ice Machine with Bin and Filter, Manitowoc, Model #ID-0322 with Bin B-320:**
This 22" wide ID-0322A air cooled ice machine features state-of-the-art intelligent diagnostics, providing 24-hour preventative maintenance and diagnostic feedback for trouble-free operation. The Manitowoc ID-0322A ice machine can make up to 350 lb. of half size ice cubes per day. A customizable ice making schedule allows for fluctuations in daily levels of production. Simply program the machine to produce ice by on/Off Time or Ice Volume. Its EasyRead display communicates operating statuses to your staff, as well as cleaning reminders, and asset information through an eye-catching blue illuminated display. Featuring a hard, clear-coat layer on top of an aluminum alloy, this surface is easy to wipe clean and provides protection against fingerprints and scratches. Unit will be installed on top of Bin #B-320. Filter (#54A) will be installed on ice machine as indicated on plan and be easily accessible for replacement. Electrical and plumbing connections by General Contractor. K.E.C. to assemble and position per plans.
(Equal Alternate Manufacturer [must match specification]: Scotsman)

Item #2A **Provide (1) Filter for Ice Machine, Manitowoc, Model #AR-10000:**
Supply clean, safe water to your ice machine and increase efficiency with this EV9324-21 Insurice single PF-i20002 water filtration system with pre-filter. This filtration system features a 20" pre-filter cartridge that is specially designed to reduce the amount of dirt and sediments in your water before it reaches your primary filter, thus increasing the efficiency of the entire system and extending the service life of your primary filter. This filter works with most cubers that produce up to 750 lb. of ice per day and flakers that produce up to 1500 lb. of ice per day. Boasting a 9000-gallon capacity with a 125 PSI maximum pressure requirement, this system is perfect for your waiting room, hotel lobby, or cafeteria ice machine. To ensure that even the smallest of contaminants can't slip through the filter, this system has a low micron rating of .5 and a flow rate of 1.67 GPM, guaranteeing a consistent flow without sacrificing cleanliness. Dimensions: 14-1/8” W x 6-1/2” D x 25-5/16” H. K.E.C. to assemble and position per plans. Install with item #220 Ice Machine in location indicated on plans and in a position to allow for easy operator access for replacement.

Item #3 **Provide (1) Floor Trough, Aero, Model #FT-1236-SG:**
Floor Trough, 36"W x 12"D, stainless steel subway grating, drain pan has built-in pitch toward drain, stainless steel waste with basket, 14 gauge stainless steel body. Complete Installation by Kitchen Equipment Contractor. Plumbing connection by General Contractor. Position at location per plans. Refer to Drawings for location of each item. Unit will be located per plans in front of ice machine.
(Equal Alternate Manufacturer [must match specification]: IMC Teddy, Eagle, Advanced Tabco)

Item #4 **Provide (2) Enclosed Carts, New Age, Model #1290B:**
Heavy duty, high tensile, extruded aluminum. Type 6063-T5 alloy. UPPER FRAME & TOP: The upper frame is constructed of vertical uprights 1" x 2-½" x 1/8" thick extruded aluminum channels with top cross and side bracing of 1-¼" x 1-¼" x .070 wall extruded aluminum tubing, all fully welded together. A solid cap of .063 thick aluminum is welded to uprights and cross bracing. The compound guides are interlocking solid wall type, extruded aluminum panels. Each panel has a series of guides spaced 1-½" on center, with ½" ledges and .090 wall thickness. The guides are welded to the vertical uprights. Rear panel is .080 thick aluminum panel with a corrugation on each side for strength and enhanced air circulation. Panel is welded to the top, bottom, and rear vertical uprights. Door consists of 1/8" thick aluminum panel with a corrugation on each side. The door is supported by three stainless-steel hinges designed to provide 270º door swing. A positive gravity catch is provided to retain door in a closed position. A universal card holder is bolted to the upper front of the door. A ¾" x 1" x .070 wall extruded aluminum tube tie rod is welded to the front vertical uprights for extra rigidity. Bottom frame is constructed of 1/8" thick aluminum sheet with four sides bent down 1-3/8", all corners welded smoothly. Tubular framework welded inside the 1/8" aluminum sheet for extra rigidity. Caster plates (2-¾" x 4-3/8" thick pre-tapped) are welded to bottom of frame. Four platform type 5" casters, full swivel design with sealed ball bearing axle and non-marking wheels. Unit shall measure 20-7/8" W x 27-5/8" D x 68" H. K.E.C to fully assemble, place in position shown, and provide to Contractor for final installation. Refer to plans for location of item. Electrical connection by General Contractor. K.E.C. to fully assemble and place in position per owner/operator direction.
(Equal Alternate Manufacturers [must match specification]: Channel, Advanced Tabco)

Item #5 **Provide (4) Mobile Shelving, Metro, Model #X556PG4:**
MetroMax 4™ Mobile Shelving Unit, four tiers, 48"W x 24"D x 68"H, (4) open grid polymer shelves with removable shelf mats, 500 lb. capacity per shelf, (4) polymer MX63UP posts, wedge connectors, (4) polymer casters (2 swivel & 2 braked), built in antimicrobial product protection, NSF. Kitchen Contractor to fully assemble and place in positions shown on plan.
(Equal Alternate Manufacturer [must match specification]: Channel, Advanced Tabco, Aero, IMC Teddy)

Item #6 **Provide (1) Walk-in Cooler/Freezer, KolPak, Custom:**

Refer to plans for location and dimensions. Walk-in Cooler/Freezer will have approximate external dimensions of 211" x 97" with an interior cooler section measuring 12'-8" x 7'-6" x 7'-10 5/8"; and an interior freezer section measuring 4'-0" x 7'-6" x 7'-10 5/8". Unit will have an insulated floor with internal ramp into the cooler section. Walk-in floor will be placed on finished concrete slab, with no depression.

Walk-In Coolers/Freezer must be field measured before construction. The standard 2" air gap needs to be followed along the entire perimeter of the walk-in space, between the walls and walk-in panels. Certified and licensed installation is required.

The following General Specifications are basic requirements. Detailed Specifications that follow supersede General Specifications as per project requirements.

General Specification:
Walk-ins shall be constructed of pre-fabricated modular panels as manufactured in exact size and shape as shown on plan. They shall be designed for easy and accurate field assembly, future enlargement by the addition of panels or dismantling should relocation to an alternate site be desired. Construction shall be in strict compliance with NSF Standard 7.

Panel Construction - All panels shall consist of interior and exterior metal surfaces precision formed to exact dimensions with double 90° edges to enhance overall panel rigidity. The finished metal surfaces shall be fitted

with a teardrop profile gasket and placed in precision tooled fixtures where they are injected with *Foamed-in-Place* urethane insulation. Curing of the insulating core shall take place at a controlled temperature within the foaming fixture to provide permanent adhesion to the metal surfaces, allowing for uniform foam expansion and to maximize finished panel strength. Panel edges shall have a molded urethane tongue and groove profile of insulation factor equal to core material to accurately align panels during installation and to assure an airtight seal. No structural wood, steel, straps, high density urethane or other lesser-insulating materials shall be used in panel construction. Finished panels must be UL classified building units.

Finished panels will be 4" thick and will be provided in 11 ½", 23", 34 ½" and 46" widths to conform to project drawings. Corner panels shall be one piece 90° angled construction and shall measure 12" x 12" or 12" x 6 ¼" where required. For units with multiple compartments, specially designed "tee" panels shall be provided to form partition wall to outside wall junctures. "Tee" panels shall measure 23" x 12" or 23" x 6 ¼" where required. All panels shall be interchangeable with like panels or standard door frame sections for fast and easy assembly.

Floor Construction - Where pre-fabricated floor panels are required, they shall be of similar design to other panels and shall incorporate a fully die formed 1/4" NSF coved radius at all interior floor to wall junctures. Floor panels shall be capable of supporting evenly distributed loads up to 600 pounds per square foot and will be equipped with foamed-in-place integral interior ramps, fully welded without overlap, hem or fasteners when and where shown.

Where floorless units are required, a 1 3/4" high 5 chamber vinyl floor screed shall be provided to attach all wall panels to finished building floor. Floor screeds incorporate NSF coves on interior and exterior sides and shall be mechanically fastened to fit flat against the finished floor. Floor screeds and wall panels shall have matching tongue and groove edges and cam lock together to form an air-tight seal leaving no exposed fasteners.

Door Construction - Entrance doors are constructed similar to other panels and shall be flush mount, magnetic in-fitting type. Door sections shall be constructed to conform to Underwriters Laboratories Standards for electrical safety and shall bear all appropriate U.L. listing labels. The perimeter of the door and frame shall be built of a fiberglass reinforced polymer (FRP) pultrusion weighing not less than 11 ounces per linear foot. All pultrusions shall be non-conductive, non-corrosive, rust proof and listed by the National Sanitation Foundation. Door jamb shall house a door frame heater circuit and a magnet attracting stainless-steel trim strip. Door frame shall be equipped with flexible bellows type vinyl door gasket with magnetic core and flexible EPDM (ethylene propylene diene monomer) door sweep. Standard door frame sections 46", 57 ½" or 69" wide shall be equipped with a vapor proof light fixture and globe pre-wired to a pushbutton type light switch with pilot light. An aluminum braided heater wire monitored and controlled as to initiation temperature, termination temperature and percentage of operation time is required.

Walk-In Monitoring System – System to have a five-digit LED display with high and low alarm set points with audible and visual alerts for alarm conditions. All functions shall be programmable and accessible from the face of the controller.

System shall have an integrated, push button light switch with on/off indicator light. System shall comply with Jan 1, 2009 federal energy requirements by incorporating an automatic lighting shut-off. System shall actively monitor and control door heater assembly for proper operation and lower energy consumption by having programmable initiation temperature, termination temperature and percentage of operation time adjustability. System to have 115V output for connection to external alarms, dialers, etc. that run on standard 115V input. Where specified, the system shall be supplied with a dry contact kit for connection to equipment that requires dry contacts.

Door hardware shall be die-cast zinc with brushed satin finish. Doors shall be mounted with heavy duty polished hinges. Pull handle assembly shall incorporate a keyed cylinder deadbolt style lock provision for owner supplied padlock and an inside safety release to prevent personnel entrapment. Positive door closing, and sealing shall be assisted by a hydraulic closer device to ensure automatic door closure. Door(s) shall come equipped with factory mounted, full length strip curtains at all exterior doors.

Finishes - The interior and exterior finish on panel surfaces is to be manufactured from a combination of the following premium grade materials. The gauge or thickness of the metal material listed is rated prior to embossing (See Detailed Specifications for this unit's finish selections):

A. Interior walls shall be 26 ga. stucco Acrylume, and interior ceilings shall be 26 ga. white stucco galvanized steel
B. Exposed Exterior walls shall be 26 ga. white stucco galvanized steel
C. Unexposed exterior walls shall be 26 ga. stucco Acrylume
D. Interior floor shall be 1/8" integral diamond treadplate aluminum
E. Exterior floor and ceiling shall be 26 ga. stucco Acrylume

Insulation - Insulation shall be 4" thick high-pressure impingement mixed (HPIM) foamed-in-place urethane, minimum 2.4 lb. per cubic foot density, fully heat cured and bonded to metal finishes. The insulation shall be manufactured using an HFC 245fa expanding agent. The 20º F thermal conductivity ("K" factor) shall not exceed 0.1232 BTU/Hour/Square Foot/Degree Fahrenheit/Inch of Thickness across the entire width of the panel. Overall coefficient of heat transfer ("U" factor) shall not be less than 8.117 and the resistance to heat penetration ("R" factor) shall not be less than 32. The 50-degree F "K" factor shall not exceed 0.1378, the "U" factor shall not be less than 7.257 and the "R" factor shall not be less than 29.02. The insulation shall have a 97% closed cell structure to prevent absorption of liquids. The finished panel (not just the core material) shall be listed by Underwriters Laboratories as a Class 1 (UL-723) building unit and demonstrate a flame spread rating of 20 or less. The core material smoke developed Underwriters Laboratory rating shall be no greater than 300 as documented by and in accordance with ASTM-E84 Standards. 4" thick panels must meet performance standards as outlined in U. S. Government HR-6 legislation.

Panel Assembly - Assembly of walk-in shall be accomplished by the use of cam-action locking mechanisms precisely positioned along the outside tongue or groove edges of each panel to exactly correspond with a matching mechanism in the adjacent panel. Cam lock spacing on vertical joints shall not exceed 46" and at junction of vertical and horizontal joints by 23". Cam locks shall be foamed-in-place and anchored securely in the panel by steel "wings" integral to the lock housing. Cam locks shall be operated through access ports by the use of a hex wrench, thereby, pulling the panels together and establishing an airtight seal. All access ports shall be located on the walk-in interior to facilitate assembly when close to building structures and shall be covered by vinyl snap-in caps after final assembly. Complete step-by-step assembly instructions and erection drawings shall be supplied by the walk-in manufacturer and installing contractor must be factory authorized!

Accessories – Walk-in interiors shall be illuminated with energy efficient LED light fixtures as shown on drawing, 4 feet long, Kason 1810 appropriate for compartment operating temperature. All Doors shall have a digital audio/visual temperature alarm with 115V remote power output, delayed temperature reading to eliminate false "spiked" readings in temperature, adjustable pulsating door heater control and adjustable auto lights off control. Closure panels to a 10' ceiling and vertical trim strips to match box exterior to be provided by KEC. Each compartment shall be equipped with a panel mounted Kason 1832 pressure relief vent.

Warranty - Insulated panel products are to be warranted for a period of ten (10) years after date of installation to the original user should the panels be installed properly and be used under normal service conditions. Installing contractor is to closely adhere to manufacturer's recommendations and guidelines for installation so

as to ensure a quality operating product and when possible has attended and completed factory installation training curriculum. All accessories and components shall have a one-year warranty.

Refrigeration System - All system field connections shall be made by a licensed refrigeration contractor (as a subcontractor to the kitchen equipment contractor) that is certified in refrigerant recovery. Condensing units shall be preassembled remote, fully hermetic, air cooled units for outdoor installation as manufactured by Copeland or Tecumseh and shall be supplied with matching Heatcraft evaporators. Condensing units shall be equipped with PSC fan motors and evaporator fans shall utilize the ECM type fan motors. All evaporators shall be equipped with QRC factory mounted from Heatcraft, which includes Electronic expansion valves, superheat control, defrost algorithms and fan cycle control. Medium temp units shall utilize R-448A refrigerant and low temp units shall also utilize R448A. Manufacturer is to calculate heat loads and provide systems with a minimum of 105% of needed capacity to maintain holding temperatures of 35° F in coolers and –10° F in freezers. Calculations shall take into consideration box ambient, refrigeration system ambient, air flow, exposure to sunlight and altitude. Interconnection of refrigeration lines, insulation and electrical wiring shall be accomplished by the appropriate trades and shall be a portion of the kitchen equipment contract.

Refrigeration Accessories – A weatherproof cover, low ambient controls, and a 12” high mounting stand shall be provided for each outdoor condensing unit. Each system shall also be equipped with factory mounted electronic expansion valve, moisture detecting liquid eye, filter drier, digital thermostat control, pressure control. Low temp units also are to include factory mounted heat exchangers and evaporator drain line heaters.

Refrigeration Warranty - All parts shall be warranted for one year from date of installation with an additional four (4) year compressor warranty added by the manufacturer. A one-year labor warranty of the system is to be provided by the licensed installation contractor as a subcontractor to the kitchen equipment contractor.

Detailed Specification:

1 – Walk-in Cooler/Freezer

Compartments:

+35 Cooler

Interior Dimensions: 12'-8" x 7'-6" x 7'-10 5/8"

Walls:
4" Class 1 - Foamed in place Urethane
Exterior: Galvalume - Embossed White 26Ga.
Interior: Galvalume - Embossed White26Ga.

Ceiling:
4" Class 1 - Foamed in place Urethane
Type: Standard
Attachment: Lock Down
Exterior: Galvalume - Embossed 26 Ga
Interior: Galvalume - Embossed White 26Ga.

Floor Application:
4" Class 1 - Foamed in place Urethane
Type: Standard 1000# ERA
Finish: Aluminum - Smooth Aluminum .100
Overlay: Floor Overlay - Full Compartment, 3/16" Aluminum – Diamond Tread

Compartment Accessories:

Qty	UoM	Description
33	lf	Cove Base, Galvalume Embossed White 26 ga 1.25 x 4.25
1	ea	Air Shield

1	ea	Angle Box Modification (Tops)
1	ea	Angle Box Modification (Floors)
1	ea	Miscellaneous Adder
		KE2 Therm alarm display
2	ea	Light Fixture - Kason 1810LC LED 48IN 120/230V 50/60HZ (Diode Strips)

Refrigeration:

Qty	UoM	Description
1	ea	Standard PC99MOP-2E, 208-230/60/1, 1 HP, R404A, Medium Temp Standard Pre-Charged Air-Cooled Hermetic Condensing Unit, Amps: 7.2, Ambient Temperature: 105 Includes Fan Cycle Controls, Amps: 7.2, Ambient Temperature: 105
1	ea	KAM26-117-1EC-PR-4 AM26-117-1EC-PR-4, 115/60/1, R404A, Medium Temp, Air Defrost, Standard Unit Cooler, Amps: 1.6

One year parts and labor included

Refrigeration Accessories:

Qty	UoM	Description
1	ea	Suction Filter SFD13S5-VVSTD 5/8 ODF
1	ea	Oil Separator, S-5582, 1/2 (Factory Installed)

Door:
36" x 78" Right Swing Out Recessed 0" with 0" Leveling Sand and 0" Tile & Grout.

Frame:
Exterior: Galvalume - Embossed White26Ga.
Interior: Galvalume - EmbossedWhite 26Ga.

Plug:
Exterior: Galvalume - EmbossedWhite 26Ga.
Interior: Galvalume - Embossed White26Ga.

Door/Opening Accessories:

Qty	UoM	Description
1	ea	Handle - Kason 27C Brushed Chrome
1	ea	Door Closer - Kason 1094 Brushed Chrome
1	ea	Thermometer - 2 inch Dial w/6' Lead (STD)
1	ea	Viewport - 14X14 Cooler, Heated Frame (4" Door)
1	ea	Vent - Pressure Relief, Heated Kason 1825 (STD)
1	ea	Center Door Section Light Over Door
1	ea	Ramp - Interior 36x20
3	lf	Threshold, Stainless Steel 10 ga
3	ea	Hinge - Kason 1346 Brushed Chrome Adjustable (Spring Assisted)
1	ea	Light Fixture - Kason 1803 LED w/Bulb, Globe & Nightlight 120V (STD)
1	ea	Heater Wire, 1 Watt / FT

-10 Freezer

Interior Dimensions: 4'-0" x 7'-6" x 7'-10 5/8"

Walls:
4" Class 1 - Foamed in place Urethane
Exterior: Galvalume - Embossed White 26Ga.
Interior: Galvalume - Embossed White26Ga.

Ceiling:
4" Class 1 - Foamed in place Urethane
Type: Standard
Attachment: Lock Down
Exterior: Galvalume - Embossed 26 Ga
Interior: Galvalume - Embossed White 26Ga.

Floor Application:
4" Class 1 - Foamed in place Urethane
Type: Standard 1000# ERA
Finish: Aluminum - Smooth Aluminum .100
Overlay: Floor Overlay - Full Compartment, 3/16" Aluminum – Diamond Tread

Compartment Accessories:

Qty	UoM	Description
24	lf	Cove Base, Galvalume Embossed White 26 ga 1.25 x 4.25
1	ea	Light Fixture - Kason 1810LC LED 48IN 120/230V 50/60HZ (Diode Strips)

Refrigeration:

Qty	UoM	Description
1	ea	Standard PC199LOP-2E, 208-230/60/1, 2 HP, R404A, Low Temp Standard Pre-Charged Air Cooled Hermetic Condensing Unit, Amps: 18.1, Ambient Temperature: 105 Includes Fan Cycle Controls, Amps: 18.1, Ambient Temperature: 105
1	ea	KEL26-090-2EC-PR-4 EL26-090-2EC-PR-4, 208-230/60/1, R404A, Low Temp, Electric Defrost, Standard Unit Cooler, Amps: 9.8

One year parts and labor included

Refrigeration Accessories:

Qty	UoM	Description
1	ea	Suction Filter SFD13S7-VVSTD 7/8 ODF
1	ea	Suction Accumulator VA-56-7SRD 7/8
1	ea	Oil Separator, S-5582, 1/2 (Factory Installed)

Door:
36" x 78" Right Swing Out, Recessed 0" with 0" Leveling Sand and 0" Tile & Grout.

Frame:
Exterior: Galvalume - Embossed White26Ga.
Interior: Galvalume – Embossed White 26Ga.

Plug:
Exterior: Galvalume – Embossed White 26Ga.
Interior: Galvalume - Embossed White26Ga.

Door/Opening Accessories:

Qty	UoM	Description
1	ea	Handle - Kason 27C Brushed Chrome
1	ea	Door Closer - Kason 1094 Brushed Chrome
1	ea	Thermometer - 2 inch Dial w/6' Lead (STD)
1	ea	Viewport - 14X14 Freezer, Heated Frame and Glass (4" Door)
1	ea	Vent - Pressure Relief, Heated Kason 1825 (STD)
1	ea	Center Door Section Light Over Door
3	lf	Threshold, Stainless Steel 10 ga
1	ea	Heater Wire, 5 Watt / FT
3	ea	Hinge - Kason 1346 Brushed Chrome Adjustable (Spring Assisted)
1	ea	Light Fixture - Kason 1803 LED w/Bulb, Globe & Nightlight 120V (STD)

Field Measurement is required prior to construction. **Closure panels will be provided and match white exterior finish and provide closure to ceiling and adjacent walls.** Provide fabricated drawings for approval by Consultant prior to manufacture. Complete Assembly and Installation by Certified Installer. Electrical connection by General Contractor. Position at location per plans. Operational training will be provided to the user.
(Equal Alternate Manufacturer [must match specification]: American Panel, Imperial Brown)

Item #7 **Provide (LOT) Walk-in Shelving (Future), Metro I Shelving, Model (16) MX2448G, (8) MX2436G, (4) MX2460G, (28) MX74P:**

7 total shelving units – 1 unit measuring 24”x60”, 4 unit measuring 24”x48” and 2 units measuring 24” x 36” – shall be supplied with 4 adjustable shelves per unit. MetroMax i™ Polymer Shelving with *Microban Antimicrobial Product Protection is corrosion proof and easy to clean. Weight capacity for evenly distributed loads: 800 lbs. per shelf for lengths of 24" to 48" and 600 lbs. per shelf for lengths of 54”. Polymer mats can be easily removed and cleaned in a sink or dish machine. Microban antimicrobial product protection is built into the high contact areas of the shelf including the mats, frames, and posts to protect the product from bacteria, mold, mildew, and fungus that cause odors and product degradation. Open grid shelves promote air circulation and light penetration. One-piece solid mats contain spills and are ideal to protect items on the bottom shelf from dirt or backsplashes from cleaning floors. MetroMax i™ can be used continuously within a range of -20/120° F (-29/49° C) with intermittent exposure to 212° F (100° C) for cleaning. Provide with bumpers. Refer to Drawings for location of each item. Shelves and Posts shall be in sizes listed below:

(4) MX2460G SHELVES
(8) MX2436G SHELVES
(16) MX2448G SHELVES
(28) MX74P POSTS

Complete Assembly and Installation by Kitchen Equipment Contractor. Position at location per plans.
(Equal Alternate Manufacturers [must match specification]: Aero, IMC Teddy, Eagle, Advanced Tabco)

Item #8 **Provide (1) Double Door Freezer, True Mfg., Model #T-49F:**

True T-49F is a reach-in freezer with two solid, self-closing doors. This freezer is constructed of only the highest quality materials and is produced in the USA. An oversize condenser and extra-large evaporator coil ensure that a steady holding temperature of -10°F is maintained. The unit also features a bottom mounted compressor, which runs in the coolest, most grease free area of the kitchen and provides the added bonus of extra storage space on top and keeps the condenser coil easily accessible for cleaning. The exterior of the True T-49F is

constructed of a stainless steel front with aluminum ends, back and top. The interior is an NSF approved, white aluminum liner with a stainless steel floor. Foamed in place insulation throughout the entire cabinet structure and doors ensures exceptional energy efficiency and food safety. The unit includes three adjustable vinyl coated shelves for per door, 4-5" Heavy duty casters, Door Locks and Exterior Dial Thermometer and is equipped as 115/60/1 phase, 15 amp dedicated outlet with Cord and plug set included. Provide with 4 additional adjustable shelves (2 per side). K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location of each item. Electrical connection by General Contractor.

Item #9 **Provide (1) Double Door Refrigerator, True Mfg, Model #T-49-HC:**
T-49-HC is a 54-1/8" wide, T Series 2 section reach-in refrigerator from True with 2 solid swing stainless steel doors. This T Series 2 section reach-in refrigerator has a stainless steel front, aluminum sides, clear coated aluminum interior and has 6 adjustable PVC coated shelves. R290 Hydrocarbon refrigerant is used in this T Series 2 section reach-in refrigerator. The unit includes three adjustable vinyl coated shelves for per door, 4-5" Heavy duty casters, Door Locks and Exterior Dial Thermometer and is equipped as 115 Volts, 60 Hz, 1-phase and 5.4 Amps for 1/2 HP and comes with a 9 ft power cord with a NEMA 5-15P plug. Provide with 4 additional adjustable shelves (2 per side). K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location of each item. Electrical connection by General Contractor.

Item #10 **Provide (1) SS Open Based Prep Table with Riser and Drawer, Custom Aero or Approved Fabricator, Model #3TSBX-3072:**
Table shall be 72" long and 30" deep and shall be constructed of 16-gauge, 300 series stainless-steel top with stallion edge on front, 5" Stainless-Steel back riser (on back and right side) and open base. Delux™ Work Table, 72"W x 30"D x 39"H, 16/304 stainless steel top reinforced with (3) steel box channels, 4"H backsplash, sound deadened underside, galvanized steel gussets, 16/304 stainless steel legs with side & rear cross bracing, adjustable white metal feet, Aero Hemmed Safety Edge™, shipped KD, NSF. T-118 Delux™ drawers, stainless steel face & pan, 15" x 20", roller bearing slides. T-138 Welded Set Up, per table, includes crating. Refer to Drawings for location of each item. Provide fabrication/submittal drawings for approval prior to manufacture to the Food Service Consultant. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location of each item. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Eagle, Advanced Tabco, IMC Teddy)

Item #11 **Provide (3) Ingredient Bins, Cambro, Model #IBSF27:**
Each unit shall be one piece, seamless, single-wall molded construction made of FDA Approved white polyethylene. Unit capacity is 27 gallons. It shall have four each 3" (7,6 cm) casters with 1-1/4" (3,2 cm) wide tread, 2 front swivel and 2 fixed, mounted on molded-in steel plates. It shall have an injection molded, transparent, slide-back polycarbonate lid. It shall not exceed 29" (73,6 cm) in height so that it can store under standard work tables. It shall be available in white only with a clear cover. K.E.C. to fully assemble and place in in position.
(Equal Alternate Manufacturers [must match specification]: Rubbermaid, Uline)

Item #12 **Provide (1) SS Prep. Table with Riser, Sink, Faucet, and Drawer, Custom Aero or Approved Fabricator; Custom #3TSBX-3096:**
Custom Prep Table shall be size, and shape as shown and shall be constructed of 16-gauge, 300 series Stainless-Steel top with stallion edge on front, 5" Stainless-Steel backsplash/riser with 90 degrees turn down on right and back sides. Table top shall be reinforced with 1" x 2" channels running the entire length of the table. Base shall be Stainless-Steel. Legs shall be 1-5/8" OD, 16-gauge tubular Stainless-Steel with adjustable bullet style feet, mounted into Stainless-Steel gussets. Provide with back and right side risers, sink with faucet on left side, drawer, and undershelf on side opposite sink – refer to plans for detail locations. Table shall be 35-¾" high. Back Riser should be sealed to wall. Delux™ Work Table, 96"W x 30"D x 39"H, 16/304 stainless steel top reinforced with (3) steel box channels, 4"H backsplash, sound deadened underside, galvanized steel gussets,

16/304 stainless steel legs with side & rear cross bracing, adjustable white metal feet, Aero Hemmed Safety Edge™, shipped KD, NSF. T-141 Side Splash, 4", per linear foot. T-103 Weld-In Sink, one compartment, 20" x 20" x 14" deep, complete with basket & deck mount gooseneck faucet, NSF. SU-3060 Premium Undershelf, 60"W x 30"D, 18/430 stainless steel, fully adjustable, for 60"W x 30"D work table, NSF (can also be used as intermediate shelf). 8 ft MOD Marine edge, per linear foot. T-138 Welded Set Up, per table, includes crating Refer to Drawings for location of each item. Provide fabrication/submittal drawings for approval prior to manufacture to the Food Service Consultant. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location of each item. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Eagle, Advanced Tabco, IMC Teddy)

Item #12A **Provide (1) Service Faucet, Aero, Model #S-02:**
Stainless-Steel 12", 8" OC (T&S) service faucet will be provided and mounted on sink within #12. Complete Assembly and Installation by Kitchen Equipment Contractor. Position at location per plans. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Eagle, T&S, Elkay, Advanced Tabco)

Item #12B **Provide (1) Drop-in Sink, Aero, Model #T-103:**
Installed in Custom fabrication (#12) – see plans for details and location. Top mounted drop-in sink is constructed of Heavy gauge type 304 series stainless-steel coved bowls with large radius. Crumb cup strainer assembly features 4-1⁄2″ (114mm)-diameter top flange and 1-1⁄2″ (38mm) NPS outlet. All sinks feature deck-mounted faucet on 4″ (102mm) centers; one-compartment sinks with 16″ x 19″ (356 x 406mm) bowls include faucet with gooseneck spout. Self rimming, Deep-drawn bowl. Plumbing connection by General Contractor. Refer to Drawings for location. K.E.C. to fully assemble and place in position shown on plan.
(Equal Alternate Manufacturers [must match specification]: John Boos, Advanced Tabco)

Item #13 **Provide (1) SS Prep. Table, Custom Aero or Approved fabricator, Model #3TSB-3060:**
Custom Prep Table shall be size, and shape as shown and shall be constructed with 4" Backsplash features a 16GA 304 Type Stainless Steel Top measuring 60"W x 30"D. Includes an 18 gauge 430 series stainless steel lower shelf. Tubular legs are 1-5/8" O.D. 16 gauge stainless steel, complete with 1" adjustable impact resistant, metal feet. Stainless steel benches are sound deadened to resist vibration with 1-7/8" hemmed safety edges. Fully welded gussets for extra rigidity. NSF® Listed. Base shall be Stainless-Steel and adjustable SS Undershelf. Legs shall be 1-5/8” OD, 16-gauge tubular Stainless-Steel with adjustable bullet style feet, mounted into Stainless-Steel gussets. Provide with back riser, T168 Can Open Provision, AND 6-t138 Welded Set-up, per table, including crating (option). Back Riser should be sealed to wall. Provide fabrication/submittal drawings for approval prior to manufacture to the Food Service Consultant. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location of each item.
(Equal Alternate Manufacturers [must match specification]: Eagle, IMC Teddy, Aero, Advanced Tabco)

Item #13A **Provide (1) Can Opener - Table Mount, Edlund, Model #U-12 NSF:**
U-12 Opener with Stainless-Steel base features quick change gear, Stainless-Steel slide bar and pull pin for easy blade replacement. To be mounted on table per plans or at location per owner’s discretion. K.E.C. to assemble and position per plans.
(Equal Alternate Manufacturers [must match specification]: Vollrath, Nemco)

Item #14 **Provide (1) Slicer, Univex, Model #7512:**
Slicer shall be Medium Duty, manual or automatic type designed to be used up to 8 hours a day. Slicer to have a German 12” hollow ground blade with a permanent blade edge guard. Slicer can be used for any amount of cheese. Slice thickness can be up to 1-3/16” Slicer shall be provided with a Pilot light indicating when knife and motor are on. Slicer shall be of polished anodized aluminum surfaces with slip grooves. Slicer to have a built-in sharpener and a meat holder. Carriage shall be gear driven, permanently lubricated with automatic clutch.

Carriage and circular blade guard on slicer shall be removable for cleaning. Carriage shall be capable of doing 35 strokes per minute in automatic. Unit shall be supplied with a 120-volt, single phase cord and plug. Motor to be ½ HP capacitor start, capacitor run, 1725 RPM, with a 4.0-amp draw. Unit shall be UL and NSF listed and shall carry a one-year parts and labor warranty. Unit shall be provided with 1000452 slicer cover to protect slicer when not being used from dirt and debris. Refer to Drawings for location of item. K.E.C. to fully assemble and place in position shown on plan. Electrical connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Hobart, Bizerba, Berkel)

Item #15 **Provide (1) Mobile Slicer Stand, Aero, Model #3MSU-3030:**
Mixer Stand, open base with bottom shelf, 30"W x 30"D x 25-1/2"H, 1- 7/8" turn down on (4) sides, marine edges, (3) steel box channels, 16 gauge 300 series stainless steel top, legs and undershelf, fully adjustable undershelf, Aero Hemmed Safety Edge™, shipped KD, NSF. Provide with 4 T-128B Casters, 4", non-marking, rubber, set of 4 (2 with brakes, 2 without brakes), for equipment stands and Vertical Corner Bumpers (4). Designed to accommodate 13" x 18", 14" x 18" and 18" x 26" pans. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location of item.
(Equal Alternate Manufacturers [must match specification]: Aero, Eagle, Channel, Advanced Tabco)

Item #16 **Provide (1) 20 Qt. Mixer, Univex, Model #SRM20:**
Mixer shall be 20-quart capacity with a ½-HP Capacitor start motor. Mixer shall have a variable speed drive with four fixed speeds or any speed in-between and shall be capable of changing speeds without having to stop the mixer. Safety guard shall be two pieces, swing into place, no tool removable type for easy install and use. Mixer shall be supplied with a 20-quart stainless steel mixing bowl, a 20-quart flat beater, wire whip and a dough hook. Mixer shall have a #12 power take-off hub, for using attachments. Mixer shall be driven using hardened alloy gears in the transmission. Body shall be of a durable NSF approved hybrid epoxy/polyester powder coat finish. Mixer shall have interlock safety switches to protect the end user from injury when the bowl is lowered or when the safety guard is opened. Electrical requirements: 115/60/1PH, NEMA 5-15P, 8.6 Amps. K.E.C. to fully assemble and place in position shown on plan. Electrical connection by General Contractor.

Item #17 **Provide (1) Mobile Mixer Stand, Piper, Model #MX-29-TSS with MX-52-R:**
Piper Mixer Stand is versatile and heavy-duty. Include optional MX-52-R - Accessory Rack 52"H. Unit has a 14-gauge Stainless-Steel top with Stainless-Steel plug over opening marine edge. Base of stand shall be of 1-5/8" O.D. steel tubing legs with Stainless-Steel under shelf. Stand is equipped with Four 4" diameter heavy duty casters, two with brakes. Table shall be NSF certified. Refer to Drawings for location of each item. K.E.C. to fully assemble and place in position shown on plan. *(Equal Alternate Manufacturers [must match specification]: Aero, Channel, Advanced Tabco, Eagle)*

Item #18 **Provide (5) Hand Sink with Faucet - Wall Mount, Aero, Model #XHSF:**
Sink shall be Constructed of 16 gauge type 304 stainless steel for maximum corrosion resistance. 14"L x 10"W x 5"D Basin bowl and includes 7" gooseneck faucet, 8" high back-splash, wall brackets, and basket type drain. Faucet mount on 4" centers; 1/2" hot and cold supply. NSF. Complete Assembly and Installation by Kitchen Equipment Contractor per position on plans. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Aero, IMC Teddy, Advanced Tabco)

Item #19 **Provide (1) Food Processor, Robot Coupe, Model #R2N:**
Unit will be supplied with standard equipment. Unit will be supplied with (4) additional processing plates of Owner's choice. Includes motor base unit, continuous feed attachment, discharge plate, one 5/32" (4mm) slicing disc, one 5/64" (2mm) medium grating disc and 3 Qt. bowl with handle and stainless-steel smooth edge "S" blade. Control panel with push-type on and off, and pulse buttons. Motor is 1 HP, 1725 RPM, direct-drive, fan-cooled. Unit shall be UL listed and NSF Certified. 120/60/1 - 7.0 Amps. 3-year warranty on motor, 1-year parts and labor. Provide training as needed. K.E.C to fully assemble, place in position shown and provide to

Contractor for final installation. Refer to Drawings for location of each item. Electrical/Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Hobart, Sammic, Berkel)

Item #20 **Provide (1) Exhaust Hood with Fire Suppression System, Captive Aire, Model #ND2:**

General Specification: Extractor Filter Canopy Hood, Wall Style, Exhaust Only, Balance baffles, and VSP. Provide Captive Aire Exhaust Hood as shown on plans and in accordance with the following specification: Kitchen Ventilation hood(s) shall be of the Type I, exhaust only wall canopy suitable for all types of cooking applications. The hood(s) shall be U.L. 710 Listed without a fire damper (with optional) for 400°F, 600°F, or 700°F rated cooking appliances. Make-up air shall be independently provided through front, non-integral 14" width air curtain supply plenum. This plenum shall introduce air both horizontally and vertically into the space in front of the hood. The amount of air pushed through the face and air curtain can be altered via a manual damper. This manual damper can modulate allowing 0 to 50 percent through the air curtain and 50 to 100 percent through the face. The hood(s) exterior shall be 100% constructed of a minimum of 18-gauge 300 series Stainless-Steel. The hood(s) shall be constructed using the standing seam method for optimum strength and with a Performance Enhancing Lip (PEL), including fully welded corners, to improve capture efficiency by turning air back into the hood. Front panels shall be of double wall construction with 1-inch insulation to add additional strength and rigidity. An integral 3-inch air space is provided to meet NFPA® 96 clearance requirements against limited combustible walls. Filter end spacers shall be fully welded, and all other seams, joints and penetrations of the hood enclosure shall be welded and/or liquid tight. Lighter material gauges, alternate material types and finishes are not acceptable. The hood(s) shall include a filter housing constructed of the same material as the hood. The Grease-X-Tractor high efficiency Stainless filters shall be U.L. 1046 Classified and NSF Certified as manufactured by Captive Aire, in sufficient number and sizes to ensure optimum performance. Grease-X-Tractor filters shall direct the exhaust airflow through individual cyclone chambers, utilizing centrifugal impingement grease extraction technology. The filter housing shall terminate in a full-length concealed grease trough which shall be pitched towards a drain and into a removable grease container. Each exhaust collar must contain an air balancing baffle mounted at the opening to allow for up to 50% closure for balancing purposes. A factory installed temperature sensor shall be located within the canopy of the hood in order to override the switch in the event an operator fails to turn on the fans manually – ensuring safety. The hood(s) shall contain a factory engineered and pre-piped, UL Listed, Wet Chemical, Amerex® KP restaurant fire suppression system. The system piping shall be installed in the hood at the time of construction above the hood or within the supply plenum and shall be concealed from view. The system shall be capable of automatic detection and actuation and/or remote manual actuation. The system shall have the fire suppression capabilities to protect the duct(s), plenum(s), filter area(s) and cooking equipment.

Vapor proof, U.L. Listed recessed high efficiency LED light fixtures shall be pre-wired to a junction box located at the top of the hood for field connection. LED bulbs shall be provided with the hood. Wiring shall conform to the requirements of the National Electrical Code (NFPA #70- Latest Edition). There shall be a utility cabinet mounted on the wall next of the hood to house the fire suppression system, as well as an additional cabinet for the Captive Aire Vari-Flow.

Control system shall be a UL listed outlet center which shall standardly consist of the following:

- NEMA-1 Stainless-steel Enclosure within Stainless-steel Utility Cabinet
- Programmable Logic Controller (PLC)
- User Interface (one of the following)
- Keypad with LCD display
- Temperature Sensors
- Variable Frequency Drives (VFD)

A PLC mounted inside of a NEMA-1 stainless-steel enclosure capable of controlling multiple exhaust and supply fans via VFD or analog signals.

Keypad: The user interface shall be a membrane keypad with a graphic overlay and LCD display consisting of, but not limited to, a Lights On/Off button, Fan On/Off button, and Fan 100% button. The control interface shall also include a temperature interlock indicator and system fault indicator light.

- In the event of the failure consisting of, but not limited to temperature sensor(s), VFD(s), fire, the red system fault indicator on the control interface will flash until the failure is corrected.

Touch Screen: The user interface shall be a touch screen with independent fan and light control, live system monitoring dashboard, trending, fan scheduling, fan and light naming capabilities, and balancing pages for ease of proper kitchen balancing.

- In the event of the failure consisting of, but not limited to temperature sensor(s), VFD(s), fire, the touch screen will automatically go to a fault page, which will describe the current fault. The fault will remain until the failure is corrected.

Touch Screen: The user interface shall be a touch screen with independent fan and light control, live system monitoring dashboard, trending, fan scheduling, fan and light naming capabilities, and balancing pages for ease of proper kitchen balancing.

- In the event of the failure consisting of, but not limited to temperature sensor(s), VFD(s), fire, the touch screen will automatically go to a fault page, which will describe the current fault. The fault will remain until the failure is corrected.

Resistive type temperature sensors shall be mounted in the capture tank of the hood to monitor exhaust air temperatures. Temperature sensors shall be made of stainless-steel and shall be installed in a UL approved coupling. Fluctuation of exhaust temperature caused by cooking load shall be sensed by the temperature sensor and conveyed to the controller. The controller shall fully modulate the speed of the fans via the VFD or analog signal, from maximum speed down to a minimum speed to be determined by building test and balance. The system shall be capable of serving as an IMC 507.2.1.1 compliant auto start-up control to automatically start fans during cooking operations (temperature set point 115°F, adjustable). VFD(s) or analog signal(s) shall allow modulation of the fans based on the exhaust air temperature sensed by the temperature sensors. It must have a fully modulation turndown of up to 50% of maximum speed. Upon pressing the Fan 100% button, exhaust fan speeds shall go to maximum speed for 10 minutes (adjustable), or until the Fan 100% button is pressed again, which shall return the system to full temperature control. Variable drives shall be Yaskawa brand (or equivalent) mounted in the utility cabinet. Drives provide thermal overload protection to fans and eliminate the need for magnetic starters for 3 phase motors. To ensure proper building pressurization, the supply fans shall respond to changes in the exhaust fans speeds. The speed of the associated supply fan(s) is determined by the weighted average of the exhaust fans. In a fire condition, the control panel shall be capable of forcing the exhaust to maximum speed, shutdown of supply air, and shutdown of lights regardless of current fan speeds via integration with a fire system. Vari-Flow Controls are also standardly provided with a remote enable, fire system interface, and shunt trip breaker control. The canopy hood(s) shall be constructed by Captive Aire. They shall be built in accordance with the NFPA® 96, IMC, UMC, and bear the NSF Seal of Approval. The hood manufacturer shall provide, on request, the necessary data that confirms compliance with the code authorities listed above. By Others: Installation, ductwork, patching, all electrical field wiring, start-up & balance, gas or electric shutdown for fire system hook-up.

Note: Customer is responsible for additional labor charges as a result of cooking equipment layout changes after the release of the order, union labor or prevailing wage charges, or additional trips by fire system

distributor caused by jobsite delays, permits, fees or test required by local authority. Submittal will specify applicable testing and approval agencies.

Captive Aire Systems requirement for all field hook ups: All fire system detection conduit must be half inch EMT. All conduit fittings must be compression type and fully tightened. All conduit ends must be reamed and deburred and blown clear of debris prior to assembly. All conduit must be fully and robustly supported to avoid accidental fire system discharge.

Captive Aire Detailed Specification:

Hood #1 - Item 20 - Job #3701313
5430ND-2-ACPSP-F - 15ft 0" Long Exhaust-Only Wall Canopy Hood with Front Perforated Supply Plenum with Built-in 3" Back Standoff x1
- 430 SS Where Exposed x1
- Fire Cabinet on the Right Side 12.00" Width x 54.00" Length x 30.00" Height (Additional charges may apply for cabinet if not sold with fire system) x1
- FILTER - 20" tall x 16" (19.625" by 15.625") wide Stainless Steel Captrate Solo filter with hook, ETL Listed. Particulate capture efficiency: 85% efficient at 9 microns, 76% efficient at 5 microns. Used on hoods shipped AFTER 7/27/17. x11
- L55 Series E26 Canopy Light Fixture - High Temp Assembly, Includes Clear Thermal and Shock Resistant Globe (L55 Fixture), Bulbs by Others x5
- EXHAUST RISER - Factory installed 12" Diameter X 4" Height x2
- SUPPLY RISER - 12"x 28" Supply Riser with Volume Dampers x4
- SUPPLY RISER - 10" Square to 8" Round Supply Collar with 8" Round Volume Damper. Nailor 1090 Series. x8
- 1/2 Pint Grease Cup New Style, Flanged Slotted x2
- BACKSPLASH 80.00” High X 192.00” Long 430 SS Vertical (Includes End Caps & Divider Bars) x1
- Electrical Package Installation in Utility Cabinet by Plant. x1
- STRUCTURAL FRONT PANEL x1
- INSULATION FOR BACK OF HOOD x1
- Parts required to mount riser sensor 6 inches beside riser. Typically used with installations of field supplied double wall duct. x2
- RIGHT VERTICAL END PANEL 27” Top Width, 21” Bottom Width, 80” High Insulated 430 SS x1
- LEFT VERTICAL END PANEL 27” Top Width, 21” Bottom Width, 80” High Insulated 430 SS x1

Fire System #1 - 20 - Job #3701313
ANSUL-3.0/3.0 Ansul 6 gallon Fire System in Utility Cabinet (includes pre-piped hood(s) with detection, tank(s), release mechanism, microswitches and pull station). - Includes piping for hood: 1. x1
- Up to 2" Mechanical Shutoff Valve x1
****FIRE SYSTEM HOOKUP INCLUDED**

- Includes: Required hardware and nozzles for field hookup, all final connections, final test, and permit fees. Hookup includes two trip charges – one for field installation and pre-test and the second for final test with local fire inspector or AHJ. Any additional trips will require change order and extra payment.

- Excludes: Additional state fire test(s) if required, Union Labor & Prevailing Wage, Gas valve installation, all electrical connections, and hand held fire extinguisher(s).

Fan #1 DU85HFA - Exhaust Fan (EF-1) - Job #3701313

DU85HFA High Speed Direct Drive Centrifugal Upblast Exhaust Fan with speed control (speed control included for single phase only), disconnect switch and 15-3/4" wheel.
Exhaust Fan handles 1575 CFM @ -1.100" wc ESP, Fan runs at 1319 RPM.
Exhaust Motor: 0.750 HP, 1 Phs, 208 V, 60Hz, 5.2 FLA, ODP-ECM (Open Drip Proof Electronically Commutated Motor) x1
- Grease Cup for kitchen-duty centrifugal exhaust fans,
Box Dimensions 17-1/8 L X 5-1/16 W X 3-3/4 H (18 GA.) (Includes Down Spout) x1
- ECM Wiring Package for exhaust motors with PWM signal from ECPMO3 prewire. x1
- Multi-Conductor - Single Shielded Twisted Pair Cable, 18 AWG stranded (19x30) TC conductors, plenum, FEP insulation, overall shield (100% coverage), 20 AWG stranded TC drain wire, FEP jacket. Priced per foot. For use with CORE Interlock Network, light dimming 0-10VDC reference signal, and PWM signal from ECPM03 to ECM. x40
- EF-1 Curb CRB23X26E On Fan #1 Flat Curb x1
- Hinged Base for Curb. Standard Hinge attached to curb. Used on Fans with wheels 20 inches or smaller. 12 GA Galvanized. x1
- Vented Base for Curb x1

Fan #2 DU85HFA - Exhaust Fan (EF-2) - Job #3701313
DU85HFA High Speed Direct Drive Centrifugal Upblast Exhaust Fan with speed control (speed control included for single phase only), disconnect switch and 15-3/4" wheel.
Exhaust Fan handles 1575 CFM @ -1.100" wc ESP, Fan runs at 1319 RPM.
Exhaust Motor: 0.750 HP, 1 Phs, 208 V, 60Hz, 5.2 FLA, ODP-ECM (Open Drip Proof Electronically Commutated Motor) x1
- Grease Cup for kitchen-duty centrifugal exhaust fans,
Box Dimensions 17-1/8 L X 5-1/16 W X 3-3/4 H (18 GA.) (Includes Down Spout) x1
- ECM Wiring Package for exhaust motors with PWM signal from ECPMO3 prewire. x1
- Multi-Conductor - Single Shielded Twisted Pair Cable, 18 AWG stranded (19x30) TC conductors, plenum, FEP insulation, overall shield (100% coverage), 20 AWG stranded TC drain wire, FEP jacket. Priced per foot. For use with CORE Interlock Network, light dimming 0-10VDC reference signal, and PWM signal from ECPM03 to ECM. x40
- EF-2 Curb CRB23X26E On Fan #2 Flat Curb x1
- Hinged Base for Curb. Standard Hinge attached to curb. Used on Fans with wheels 20 inches or smaller. 12 GA Galvanized. x1
- Vented Base for Curb x1

Fan #3 A2-D.250-20D-MPU - Heater (MAU-1) - Job #3701313
A2-D.250-20D-MPU Direct Gas Fired Heated Make Up Air Unit with 20" Direct Drive Fan
Supply Fan handles 2700 CFM @ 0.400" wc ESP, Fan runs at 1197 RPM.
Heater supplies 136837 BTUs. 50°F Temperature Rise. [Fuel: Natural Gas]
Supply Motor: 1.000 HP, 3 Phase, 208 V, 60Hz, 3.8 FLA, ODP, Premium (E-Plus3) Eff.
Down Discharge - Air Flow Right -> Left x1
- V-Bank for Size # 2 Modular Heater with Foam EZ Kleen Filters.
For indoor installation.
- RTC Solutions • 40-90°F Discharge Temp Control x1
- Gas Manifold for DF2 GM - BTU 0 - 825001 - 7 in. w.c. - 14 in. w.c., No Insurance Requirement (ANSI), BV250-88 x1
- Cooling Interlock Relay. 24VAC Coil. 120V Contacts. Locks out burner circuit when AC is energized. x1
- Motorized Back Draft Damper 22.75" X 24" for Size 2 Standard & Modular Heater Units w/Extended Shaft, Standard Galvanized Construction, 3/4" Rear Flange, Low Leakage, LF120S Actuator Included x1
- Low Fire Start. Allows the burner circuit to energize when the modulation control is in a low fire position. x1

- Gas Pressure Gauge, 0-35", 2.5" Diameter, 1/4" Thread Size x1
- Gas Pressure Gauge, -5 to +15 Inches Wc., 2.5" Diameter, 1/4" Thread Size x1
- 5 Ton, Single Circuit Modular Packaged Cooling Option for Size 2 Modular Packaged Unit. Includes Condenser, DX Coil, Filter/Dryer Kit, Thermal Expansion Valve, R410A Refrigerant, and Refrigerant Piping. (2,000 to 3,000 cfm) NOT BUILT WITH OPPOSITE SIDE CONTROLS OR OPPOSITE AIRFLOW DIRECTION. CONDENSERS REQUIRE SEPARATE 208V, 3 PHASE POWER SUPPLY Coil = 3EZ1001R x1
- Downturn Plenum for Size 2 Cooling Coil Module - Required for Down Discharge Cooling Coil Applications x1
- DX Cooling Intake Air Thermostat and Relays Mounted in Unit - Set Point for Thermostat Should Be 85°F. x1
- Separate 120VAC Wiring Package for Make-Up Air Units. Option must be selected when mounting VFD in prewire panel or with DCV package. Provides separate 120VAC input to supply fan. This 120V signal must be run by electrician from DCV to mua switch. x1
- Profile Plate Configuration for size 2 Direct Fired Unit for low cfm applications. x1
- Indoor Hanging Cradle For The Size 2 Direct Fired Unit. 2 HSA125 Hanging Isolators per Uni-Strut Included.
- "Insulation" for V-bank Intake Option.

Electrical System #1 - 20 - Job #3701313

DCV-2111 Demand Control Ventilation, w/ control for 2 Exhaust Fans, 1 Supply Fan, Exhaust on in Fire, lights out in Fire, Fans modulate based on duct temperature. INVERTER DUTY 3 PHASE MOTOR REQUIRED FOR USE WITH VFD. Room temperature sensor shipped loose for field installation. Verify distance between VFD and Motor; additional cost could apply if distance exceeds 50 feet. Includes 2 Duct Thermostat kits. x1
- ESV751N02YXB571 - Variable Frequency Drive - 1 HP Max., 200/240 V, Single or Three Phase Input, 4.2 A Max., NEMA 1 Enclosure, with 2RJ-45 FOR MODBUS x1
- CASLink building monitoring system communications module. Requires internet & field wired ethernet connection or 3G cellular service. Includes Rev 3 Comm Module, RJ45 to modbus converter, 3 FT cat5 cable, and 1 FT of shielded twisted pair. x1
- PSP thermostat kit, includes 1x duct thermostat, quick seal, and j-box for monitoring of PSP discharge temperature. x1
- AC-PSP thermostat kit, includes 1x duct thermostat, quick seal, and j-box for monitoring of AC-PSP discharge temperature. x1
- Digital Prewire Lighting Relay Kit. Includes hood lighting relay & terminal blocks. Allows for up to 1400W of lighting each. x1
- Thermistor CABLE - 18/2 AWG GREEN WHITE, plenum rated. USED for thermistor duct stat. Per Foot Price. x40

Duct Run #1 – Item 20

(P1) DW1245DWASY-2R-S Double Wall Duct - 12" Inner 45 Duct - 2 Layers Reduced Clearance - 16" Stainless Steel Outer Shell. x1
(P2) DW1245DWASY-2R-S Double Wall Duct - 12" Inner 45 Duct - 2 Layers Reduced Clearance - 16" Stainless Steel Outer Shell. x1
(P3) DW1229DWLT-2R-S Double Wall Duct - 12" Inner Duct, 29" long - 2 Layers Reduced Clearance - 16" Stainless Steel Outer Shell. x1
(P4) DW1247DWAJD-2R-S Double Wall Adjustable Duct - 12" Inner Duct, 47" long - 2 Layers Reduced Clearance - 16" Stainless Steel Outer Shell. Min Length = 11" / Max Length = 48.5" / Adjustment = 30.5" / Adjustable Section May Need to Be Cut. Includes single and double wall "V" Clamps. x1
(P5) DW1229DWLT-2R-S Double Wall Duct - 12" Inner Duct, 29" long - 2 Layers Reduced Clearance - 16" Stainless Steel Outer Shell. x1
(P6) DW2312TPDBEX Duct to Curb Transition 3/4" Down Turn, 23" Curb to 12" Duct, 16 GA Aluminized. Used on NCA14FA & NCA14HPFA. Transition Plate OD is 23.5" Designed for Use with Exhaust Fan. Non-Standard Part. x1

(P7) DW1245DWASY-2R-S Double Wall Duct - 12" Inner 45 Duct - 2 Layers Reduced Clearance - 16" Stainless Steel Outer Shell. x1
(P8) DW1245DWASY-2R-S Double Wall Duct - 12" Inner 45 Duct - 2 Layers Reduced Clearance - 16" Stainless Steel Outer Shell. x1
(P9) DW1229DWLT-2R-S Double Wall Duct - 12" Inner Duct, 29" long - 2 Layers Reduced Clearance - 16" Stainless Steel Outer Shell. x1
(P10) DW1247DWAJD-2R-S Double Wall Adjustable Duct - 12" Inner Duct, 47" long - 2 Layers Reduced Clearance - 16" Stainless Steel Outer Shell. Min Length = 11" / Max Length = 48.5" / Adjustment = 30.5" / Adjustable Section May Need to Be Cut. Includes single and double wall "V" Clamps. x1
(P11) DW1229DWLT-2R-S Double Wall Duct - 12" Inner Duct, 29" long - 2 Layers Reduced Clearance - 16" Stainless Steel Outer Shell. x1
(P12) DW2312TPDBEX Duct to Curb Transition 3/4" Down Turn, 23" Curb to 12" Duct, 16 GA Aluminized. Used on NCA14FA & NCA14HPFA. Transition Plate OD is 23.5" Designed for Use with Exhaust Fan. Non-Standard Part. x1
3M-2000PLUS Duct - 3M Fire Barrier 2000 Plus Silicone - Used as sealant to Seal Duct Joints. x3
DW12DWCLASY-2R-S Duct - 12" Duct - 16" Double "V" Clamp - 2R Insulation & Single "V" Clamp Included - Reduced Clearance. x4
DW16DWRISER-2R-S Double Wall Riser Cover - Used On 12" Inner Riser, 4" long - 2 Layers Reduced Clearance - 16" Stainless Steel Outer Riser Shell Assembly. Includes Insulation & Single V Clamps for Inner & Outer Connections. x2

Factory Services
Service Design Verification Building Surcharge x1
Service Design Verification for CASLink Ethernet. x1
Service Design Verification for Demand Control Ventilation x1
Service Design Verification for Direct Fired Heater x1
Service Design Verification for Exhaust Fan x3
Service Design Verification for Hood x2
Service Design Verification for Modular Package Unit x1
Service Design Verification Mileage Charge: (133) x 2 = 266 total miles x1

SERVICE DESIGN VERIFICATION DISCLAIMER
Field Service Technician is responsible for one trip to site to ensure the above equipment is operating within design specifications. All equipment must be operational. Fire suppression system should be hooked-up and armed. Additional trips will result in charges to be covered by others.

INSTALLATION BY OTHERS

- By Others: Installation, ductwork, patching, all electrical field wiring, start-up & balance, gas or electric shutdown for fire system hook-up.
- Note: Customer is responsible for additional labor charges as a result of cooking equipment layout changes after the release of the order, union labor or prevailing wage charges, or additional trips by fire system distributor caused by jobsite delays, permits, fees or test required by local authority. Submittal will specify applicable testing and approval agencies.
- **CaptiveAire Systems requirement for all field hook ups:** All fire system detection conduit must be half inch EMT. All conduit fittings must be compression type and fully tightened. All conduit ends must be

reamed and deburred and blown clear of debris prior to assembly. All conduit must be fully and robustly supported to avoid accidental fire system discharge.

- CaptiveAire Systems product must be installed in accordance with installation instructions provided with equipment or available on our web site at www.captiveaire.com.
- Ductwork must be designed and installed in accordance with AMCA and ASHRAE standards as presented in CaptiveAire Systems "Guide to Designing Air Flow Systems", available at: http://www.captiveaire.com/MANUALS/AIRSYSTEMDESIGN/DESIGNAIRSYSTEMS.HTM

SHIPPING

Freight includes one shipment only, delivered to the job site address listed on this proposal. Customer is responsible for freight charges on any items shipped early. This is an estimated freight charge and is subject to change based on current freight costs when the job is released for production.

Field measurement post demolition must be done prior to final submittal/shop drawings and manufacture. All Hoods must be coordinated with Architect and MEP prior to manufacture. Operational training shall be provided upon final installation.
(Equal Alternate Manufacturer [must match specification]: Accurex)

Item #21 **Provide (1) Double Convection Oven, Moffat, Model #G32D5/2C (N):**

Gas heated Turbofan convection ovens NSF-4 and CSA listed. The ovens shall have a one-piece porcelain enameled oven chamber, stainless top and sides and safe touch vented easy clean side hinged door that offers field reversible hinging. Ovens shall have capacity for five full size sheet pans each. The ovens shall be controlled by an electronic control having separate digital displays and adjusting knobs for time and temperature functions. The oven controls shall allow both manual and programmed operating modes and have separate control keys for water injection, oven light function and timer operation. The units shall include dual halogen oven lamps. Oven requires 33,000 BTU/Hr. per each oven. 66,000 totals for both. Ovens shall be fitted with a 110-120 V/ 60 Hz/ 1 Phase NEMA 5-15P cord set. Ovens shall be double stacked using Double Stacking Kits DSKG32C (castor option). Units shall be supplied in 100% recyclable shipping packaging. Double stack models are supplied as two individual ovens and a double stacking kit for field assembly. Provide with (4) locking casters and ¾" quick disconnect hose. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location of each item. Electrical and Gas connection by General Contractor.

Item #22 **Provide (1) Single Steamer on a Stand, Accutemp, Model #N61201D SGL with Stand:**

Connectionless Evolution™ Boilerless, Convection Steamer featuring Steam Vector Technology, natural gas, holds (6) 12"x 20"x 2-1/2" deep pans, Digital Controls, NO water and drain connection required, warranty NOT voided by water quality, NO water filtration required, 60,000BTU, 120/60/1ph, 5' cord & NEMA 5-15P, ENERGY STAR®. Includes stand in configuration with locking casters. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location. Electrical and Gas connection by General Contractor.

Item #23 **Provide (1) 4-Burner Range with Oven, Wolf, Model #C24S-4BN:**

24" wide gas restaurant range, Wolf Challenger XL Model No. C24S-4BN. Fully MIG welded aluminized steel frame for added durability. Stainless steel front, sides, backriser, high shelf and casters. Extra deep crumb tray with welded corners. Four 30,000 BTU/hr. open top burners with lift-off burner heads. Energy saving flashtube open burner ignition system (one pilot for every two burners) shrouded for reliability. Heavy duty cast grates, easy lift-off 12" x 12 1⁄2" in the front and 12" x 14 1⁄2" in the back to better accommodate stock pots or large pans. Grates have a built in aeration bowl for greater efficiency. Burner knobs are cool to the touch, high temperature material. One oven: 23,000 BTU/hr. standard bakers depth ovens with porcelain oven bottom and door panel, measures 26 1⁄4"d x 20 1⁄4"w x 14"h. Oven thermostat adjusts from 250°F to 500°F with a low

setting. Oven is supplied with two racks, two rack guide sets, and four rack positions. Oven door is heavy duty with an integrated door hinge/spring mechanism requiring no adjustment. 3⁄4" rear gas connection and pressure regulator. Total input 143,000 BTU/hr. Exterior Dimensions: 34"d x 24"w x 58"h. Equip with on 4 heavy duty casters, with 3/4" x 4' flex hose & quick disconnect, with restraining and Flame Safety device with manual spark ignition for all open top burners, thermostatic griddles and oven pilots. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location. Gas connection by General Contractor.

Item #24 **Provide (1) Griddle with Oven, Wolf, Model #C36S-36GN:**

36" wide gas restaurant range, Wolf Challenger XL Model No. C36S-36GN. Fully MIG welded aluminized steel frame for added durability. Stainless steel front, sides, 10" stubbed back and casters. Extra deep crumb tray with welded corners. 36" manual griddle, 7⁄8" thick, 4" wide grease trough. Burner knobs are cool to the touch, high temperature material. One oven: 35,000 BTU/hr. standard bakers depth ovens with porcelain oven bottom and door panel, measures 27"d x 26 3⁄8"w x 14"h. Oven thermostat adjusts from 250°F to 500°F with a low setting. Oven is supplied with two racks, two rack guide sets, and four rack positions. Oven door is heavy duty with an integrated door hinge/spring mechanism requiring no adjustment. 3⁄4" rear gas connection and pressure regulator. Total input 95,000 BTU/hr. Exterior Dimensions: 34"d x 36"w x 58"h. Equip with on 4 heavy duty casters, 10" stubbed back, also with 3/4" x 4' flex hose & quick disconnect, with restraining and Flame Safety device with manual spark ignition for all open top burners, thermostatic griddles and oven pilots. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location. Gas connection by General Contractor.

Item #25 **Provide (1) Salamander/Broiler - Wall Mount, Wolf, Model #C36IRB-N:**

Gas salamander broiler, Wolf Model No. C36IRB. Stainless steel front, top and sides. Two 15,000 BTU/hr. ceramic infrared burners. 30,000 BTU/hr. total input. Dual heat controls with improved temperature control (250°F-800°F at rack). Pilot ignition system. Cool-to-the-touch knob on lever provides positive positioning of the broiling carriage. Heavy-duty chrome plated broiling grid measures 27 1⁄2"w x 13"d. Removable full width spillage pan. 3⁄4" top gas connection and gas pressure regulator. Exterior Dimensions: 36"w x 19"d x 17 5⁄8"h (broiler dimensions only). CSA design certified. NSF listed. Supply with SS Wall mounting brackets. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location. Gas connection by General Contractor.

Item #26 **Provide (1) Fryer, Frymaster, Model #ESG35T:**

Value High-Efficiency Fryer, NG gas, floor model, 35 lb. capacity, tube-type design, millivolt control system, temperature probe, includes: rack-type basket support, basket hanger & (2) baskets, stainless steel fry pot, front, door, backsplash/flue cover & sides, 6" adjustable steel legs, 70,000 BTU, NSF, cETLus, ENERGY STAR®, Enerlogic®. Supply with quick disconnect hose. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location. Gas connection by General Contractor.

Item #27 **Provide (1) Fryer Dump Station, Frymaster, Model #FWH-1/SC:**

Food Warmer and Holding Station, ceramic heating element with wire guard, radiant heat, includes; heat lamp, cord & plug, 12 x 20 x 2-1/2" stainless steel cafeteria-style pan & screen, Supply with Spreader Cabinet, fryer match design, 15-1/2" W, free-standing design, stainless steel (HD50G), NSF, cULus, 120v/60/1ph. K.E.C to fully assemble, place in position shown, and provide to Contractor for final installation. Refer to plans for location of item. Electrical connection by General Contractor.

Item #27A **Provide (1) Mobile Fryer Filter, Vulcan, Model #MF:**

Mobile filter system, Vulcan Model No. MF. Filter pan constructed of 16-gauge stainless steel. Stainless steel handle and casters provide mobility. Roll up to any fryer to drain and filter oil. 110 lbs. maximum filter capacity of shortening. 1⁄3 H.P. motor and pump circulates hot frying compound at the rate of 8 gallons per minute.

System provided with removable stainless steel primary crumb basket and mesh screen. Flushing/Discard high temperature hose standard. Requires 120-volt, 60 Hz, 1 phase power supply. 19.91"w x 39.38"d x 20.21"h. Comes with a limited one-year parts and labor warranty. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location of each item. Electrical/Plumbing/ Gas connection by General Contractor.

Item #28 **Provide (1) SS Chef's Table with Load Center, Upper Shelf, Warming Lights, and Dual-Temp Drop -in Unit, Custom Aero or Approved Fabricator; Custom 3STBO-36126:**

Chef's Worktable shall be size, and shape as shown and shall be constructed of 16-gauge, 304 series Stainless-Steel top with stallion edge on all sides. Table top shall have #3 polish, satin finish. Table top shall be reinforced with 1" x 2" channels running the entire length of the table. Base shall be Stainless-Steel and shall include an adjustable Stainless-Steel under shelf. Legs shall be 1-5/8" OD, 16-gauge tubular Stainless-Steel, mounted into Stainless-Steel gussets. Table shall be 35-¾" high. Table shall be NSF approved. Provide fabricated drawings for approval by Consultant prior to manufacture. Table shall have integrally attached double over shelf (Item #28A) and it will have a cut out for the Dressing Table. Table will have load center for all required appliances, see plans for details.

Chef's Side to include:

1 ea 3TSBO-36126 Delux™ Work Table, cabinet base with open front, 126"W x 36"D x 39"H, 16/304 stainless steel top reinforced with (3) steel box channels, 4"H backsplash, sound deadened underside, 18/430 stainless steel cabinet body & undershelf, 16/304 stainless steel legs with adjustable white metal feet, Aero Hemmed Safety Edge™, shipped KD, NSF

1 ea T-139 Special Size
Modified from 120'' x 30'' to 126'' x 36''

1 ea T-145 Top Cut Out, reinforced for drop in hot well, per hole

1 ea T-167 Control Panel, for food well and drop-in

1 ea MOD Lined open space for refrigerated buy out

1 ea T-138 Welded Set Up, per table, includes crating

Pick-up Side to include:

1 ea DC-18126 Dish Cabinet, 126"W x 18"D, 16 gauge 300 series stainless steel top with 1 rolled edge, (2) stainless steel undershelves, with 6" legs

1 ea T-139 Special Size
Modified from 120'' x 15'' to 126'' x 18''

1 ea T-138 Welded Set Up, per table, includes crating

Double Overshelf:

1 ea 3DO-15126 Delux™ Overshelf, table mount, 126"W x 15"D x 30"H, double-deck, 16/304 stainless steel construction, adjustable mid- shelf, 1-1/2" turn down on (4) sides, 16/304 stainless steel legs mounted with Aerolock, Aero Hemmed Safety Edge™, KD, NSF

1 ea T-172 Table Shelf Modification Modified from 132'' x 15'' to 126'' x 15''

4 ea T-161 Mount Heat Lamps (heat lamp by others)

Provide fabrication/submittal drawings for approval prior to manufacture to the Food Service Consultant. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location of each item. Plumbing and electrical connections by General Contractor. *(Equal Supplier- Aero, Eagle, Advanced Tabco)*

Item #28A **Provide (1) Double Upper Over Shelf, Custom Aero or Approved Fabricator, Model #3DO-15126 Custom:**

Custom Double SS Over shelf is 15" x 126" made to mount on/attach to SS table top. Mount at location per

plans. table mount, 126"W x 15"D x 30"H, double-deck, 16/304 stainless steel construction, adjustable mid-shelf, 1-1/2" turn down on (4) sides, 16/304 stainless steel legs mounted with Aerolock, Aero Hemmed Safety Edge™, KD, NSF. Provide within Item #28 fabricated drawings for approval by Consultant prior to manufacture. K.E.C to fully assemble and place in position as per plans.

Item #28B **Provide (4) Warming Lights/Strips, Hatco, Model #GRA-36:**

Glo-Ray® Infrared Foodwarmer, high wattage, tubular metal heater rod, single heater rod housing, aluminum construction, 800 watts, NSF, cUL, UL, 240v/60/1ph. 4 strips will be mounted in custom chef's table overshelf Item #28/28A. Provide within Item #28 fabricated drawings for approval by Consultant prior to manufacture. K.E.C to fully assemble and place in position as per plans.

Item #28C **Provide (1) Dual-Temp Drop-in 2-Well Unit, Hatco, Model #HCWBI-2DA:**

Installed in Custom Chef's Table (#28) fabrication – see plans for details and location.
Drop-In Hot/Cold Well Unit accommodates (2) full-size pans, remote mountable panel, 60" power supply whip, electronic temperature control, auto defrost, automatic water fill, condensing unit, comes with pan support bars, 3000 watts, 1/4 HP, cULus, Made in USA. 1-year on-site parts and labor warranty. Electrical: 120/208v/60/1 with 14.5 amps. Include options for extended 4-year warranty, Flush hose, cleaning brush, stopper and adapter, 12" and 20" pan support bars. K.E.C will assemble fully and place in position as per plans. Electrical Connection will be by General Contractor.

Item #29 **Provide (1) Refrigerated Dressing Table, True Mfg, Model #TFP-32-12M:**

Refrigerated dressing table is constructed of Stainless steel and features Factory engineered, self-contained, capillary tube system using environmentally friendly (CFC free) 134A refrigerant. Energy saving, factory balanced refrigeration system with guided airflow to provide uniform temperature in food pans and cabinet interior. Exclusive forced-air design holds 33°F to 41°F (.5°C to 5°C) product temperature in food pans and cabinet interior. Complies with and listed under ANSI/NSF-7. High efficiency evaporator fan motor and larger fan blades give True Food Prep units a more efficient, low velocity, high volume airflow design. Easy access to all condensing unit components from back of cabinet. Exterior - stainless steel front, top and ends. Matching aluminum finished back. 2-1/2" (64 mm) diameter castors – locks provided on front set. Stainless steel exterior with white aluminum liner to match cabinet interior. Door fitted with 12" (305 mm) long recessed handle that is foamed-in-place with a sheet metal interlock to ensure permanent attachment. Magnetic door gaskets of one piece construction, removable without tools for ease of cleaning. Two (2) adjustable, heavy duty PVC coated wire shelves 27-11/16"L x 20"D (703 mm x 508 mm). Four (4) chrome plated shelf clips included per shelf. Shelf support pilasters made of same material as cabinet interior; shelves are adjustable on 1/2" (13 mm) increments. 8" (204 mm) deep, full length removable cutting board. Sanitary, high-density, NSF approved white polyethylene provides tough preparation surface. Stainless steel, patented, foam insulated lid and hood keep pan temperatures colder Comes standard with 12 (1/6size) 6-7/8" L x 6-1/4" W x 4" D (175 mm x 159 mm x 102 mm) clear polycarbonate, NSF approved, food pans in countertop prep area. NSF-7 compliant for open food product. Unit completely pre-wired at factory and ready for final connection to a 115/60/1 phase, 15-amp dedicated outlet. Cord and plug set included. Complete Installation by Kitchen Equipment Contractor. Electrical connection by General Contractor. Position at location per plans.

Item #30 **Provide (1) Microwave, Panasonic, Model #NE1024:**

The NE-1024 Commercial Microwave Oven meets or exceeds all safety performance and sanitation standards set for commercial food service microwave ovens by UL, DHHS, FCC and NSF. Plus, oven shall have output power 1000 Watts*, stainless steel front and bottom energy feed. Must be equipped with 6-minute dial timer marked in 15 second increments, instructions and cooking times visible on oven control panel, interior oven lamp, see-through window, door safety lock system, Chef/Test Kitchen technical support and 6 months limited warranty. 120/60/1 phase with a NEMA 5-15 R plug required. 13.4 amps required. Unit size is 20-1/8" W x 16-½" D x 12"

H. Complete Installation by Kitchen Equipment Contractor. Electrical connection by General Contractor. Position at location per plans.

Item #31 **Provide (1) Toaster, Hatco, Model #TPT-120:**
Toaster model #TPT-120 evenly toasts a variety of bread products including bagels, Texas toast, waffles and English muffins. Model has four self-centering 1.25" (32 mm) extra wide slots. Durable stainless steel construction. Individual progressive color controls. Removable crumb trays for easy cleaning. A selector switch for single (or double) sided toasting (excluding TPT-120). Unit comes with 6' (1829 mm) cord with plug. 120 volts, single phase, 1800 Watts and 15 amps. Complete Installation by Kitchen Equipment Contractor. Electrical connection by General Contractor. Position at location per plans.

Item #32 **Provide (1) Hot Holding Unit, Metro, Model #CS19-CFC-4:**
Unit shall be a mobile, insulated heater/proofing cabinet. C5™ 1 Series Heated Holding & Proofing Cabinet, mobile, full height, non-insulated, clear polycarbonate door, removable bottom mount control module, thermostat to 190°F, fixed wire slides on 3" centers (18) 18" x 26" or (34) 12" x 20" x 2-1/2" pan capacity, 5" casters (2 with brakes), aluminum, 120v/60/1-ph, 2000 watts, 16.7 amps, NEMA 5-20P, cULus, NSF. Unit will be supplied with universal tray slides. Complete Assembly and Installation by Kitchen Equipment Contractor. Electrical connection by the General Contractor. Position at location per plans.

Item #33 **Provide (1) SS Prep. Table with Riser, Double Sink, Faucet, and Drawer, Custom Aero or Approved Fabricator; Custom 3TSBX-3096:**
Custom Prep Table shall be size, and shape as shown and shall be constructed of 16-gauge, 300 series Stainless-Steel top with stallion edge on front, 5" Stainless-Steel backsplash/riser with 90 degrees turn down. Table top shall be reinforced with 1" x 2" channels running the entire length of the table. Base shall be Stainless-Steel. Legs shall be 1-5/8" OD, 16-gauge tubular Stainless-Steel with adjustable bullet style feet, mounted into Stainless-Steel gussets. Provide with back risers and sink with faucet on left side - refer to plans for detail locations. Table shall be 35-¾" high. Back Riser should be sealed to wall. Delux™ Work Table, 96"W x 30"D x 39"H, 16/304 stainless steel top reinforced with (3) steel box channels, 4"H backsplash, sound deadened underside, galvanized steel gussets, 16/304 stainless steel legs with side & rear cross bracing, adjustable white metal feet, Aero Hemmed Safety Edge™, shipped KD, NSF. 2 - T-103 Weld-In Sink, one compartment, 20" x 20" x 14" deep, complete with basket & deck mount gooseneck faucet, NSF, 2 - S-19 Lever Support Bracket, stainless steel, 8 ft Mood Marine Edge, 1 - SU-3048 Premium Undershelf, 48"W x 30"D, 18/430 stainless steel, fully adjustable, for 48"W x 30"D work table, NSF. T-138 Welded Set Up, per table, includes crating Refer to Drawings for location of each item. Provide fabrication/submittal drawings for approval prior to manufacture to the Food Service Consultant. K.E.C to fully assemble, place in position shown and provide to Contractor for final installation. Refer to Drawings for location of each item. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Eagle, Advanced Tabco, IMC Teddy)

Item #33A **Provide (1) Service Faucet, Aero, Model #S-02:**
Stainless-Steel 12", 8" OC (T&S) service faucet will be provided and mounted on sink within #33. Complete Assembly and Installation by Kitchen Equipment Contractor. Position at location per plans. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Eagle, T&S, Elkay, Advanced Tabco)

Item #33B **Provide (2) Drop-in Sink, Aero, Model #T-103:**
Installed in Custom fabrication (#33) – see plans for details and location. Top mounted drop-in sink is constructed of Heavy gauge type 304 series stainless-steel coved bowls with large radius. Crumb cup strainer assembly features 4-1⁄2″ (114mm)-diameter top flange and 1-1⁄2″ (38mm) NPS outlet. All sinks feature deck-mounted faucet on 4″ (102mm) centers; one-compartment sinks with 16″ x 19″ (356 x 406mm) bowls include

faucet with gooseneck spout. Self rimming, Deep-drawn bowl. Plumbing connection by General Contractor. Refer to Drawings for location. K.E.C. to fully assemble and place in position shown on plan.
(Equal Alternate Manufacturers [must match specification]: John Boos, Duke, Advanced Tabco, Aero)

Item #34 **Provide (1) SS Over Shelf - Wall Mount, Aero, Model #3W-1248:**
Wall Shelf measures 48"W x 12"D. Shelf is made with 16 gauge, 304 Series stainless steel that has a 1-1/2" lip on 3 sides with a 3/4" radius front roll. Stainless steel brackets are easily mounted to welded studs. Top is polished to a #4 mill finish. NSF® Listed. Complete Assembly and Installation by Kitchen Equipment Contractor. Position at height approved per owner at location per plans. (*Equal Alternate Manufacturers [must match specification]: John Boos, IMC Teddy)*

Item #35 **Provide (1) SS Soiled Dish Table with Riser, Scrap Sink, Faucet, and Overspray, Custom Aero or Approved Fabricator:**
Custom Soiled Dishtable will be size and shape as per plans and be constructed of 16/304 Stainless-Steel with all seams welded, ground smooth, and polished. Delux™ Clean Dishtable, straight design, 64"W x 30"D x 40"H, left-to- right operation, 16/304 stainless steel top, 7"H backsplash with 2" sanitary return, raised rolled edges on front & side, fully welded stainless steel gussets, 16/304 stainless steel legs & adjustable crossbracing, adjustable stainless steel feet, Aero Hemmed Safety Edge™, KD, NSF. Field measurement is required for this item by installer/manufacturer. Soil table will be integral with Dish Machine. Custom Manufacturer will provide fabrication/submittal drawings for approval by Architect and Consultant prior to manufacture. K.E.C. to coordinate installation based on plans and place in position shown on plan. Plumbing connections by General Contractor.
(*Equal Alternate Manufacturers [must match specification]: IMC Teddy, Eagle, John Boos)*

Item #35A **Provide (1) Service Faucet, Aero, Model #S-02 and D-38/14GA:**
Stainless-Steel 12", 8" OC (T&S) service faucet and Pre-Rinse Faucet (T&S), 14 gauge 300 series stainless steel will be provided and mounted on sink within #35. Complete Assembly and Installation by Kitchen Equipment Contractor. Position at location per plans. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Eagle, T&S, Elkay, John Boos)

Item #35B **Provide (1) Overspray with Wall Bracket, Fisher, Model #2010-WB:**
(1) Pre-Rinse Spring Style Deck Mount Overspray – Fisher, Model #2010-WB with adjustable wall bracket and add-on 12" Service Faucet. Features include:

- Control Valve: Single Deck, Temperature Control Valve with internal spring loaded check valves, Stem-Left Hand, Hot and Cold Ended Buttons; Swiveling Seat Disks, SS Seats, Seat Screws, and Handle Screws
- Hose: 36" length, SS end fittings, external jacket, 3-ply fiber reinforced internal rubber hose
- Spray Valve: Solid brass shower head – no "O" rings to leak, Bronze handle – not plastic – means Full "On; 2.65 GPM at 80 PSI standard with shower spray pattern.
- System Limits: TEMP: 40°F MIN. TO 140°F MAX. STATIC; PRESSURE 200 PSI MAX. STATIC

Overspray and Faucet unit to be installed with Item #35 Custom Soiled Table. Provide location and position based on approved fabricated drawings for Item #35. Complete Assembly and Installation by Kitchen Equipment Contractor per position on plans. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Eagle, T&S, Elkay, Aero)

Item #36 **Provide (1) Condensate Hood, Captive Aire, Model #VHB:**

General Specification: Condensate hoods shall be of the Type II, exhaust only canopy. The hood(s) shall be 100% constructed of a minimum of 18-gauge 300-series Stainless-Steel. The hood(s) shall be constructed using the standing seam method for optimum strength. All seams, joints and penetrations of the hood enclosure shall be welded and/or liquid tight. Lighter material gauges, alternate material types and finishes are not acceptable.

The hood(s) shall include a full perimeter, welded, condensate collecting gutter with a 0.5-inch N.P.T. stainless-steel drain fitting. The hood(s) shall contain a factory mounted single gang switch plate and equipped with single 15-amp switch on the face of the hood, including an integral chase to terminate in a fully welded junction box on top of the hood. Vapor proof, U.L. Listed recessed high efficiency LED light fixtures shall be pre-wired to a junction box located at the top of the hood for field connection. LED bulbs shall be provided with the hood. Wiring shall conform to the requirements of the National Electrical Code (NFPA #70- Latest Edition). The canopy hood(s) shall be constructed by Captive Aire. They shall be built in accordance with the NFPA® 96, UMC, and bear the NSF Seal of Approval. Complete Fabrication Drawings will be required and should be furnished to the Architect and Engineer for approval, prior to manufacture. Final approval of condensate hood specifications will be by Architect and Engineer. Electrical connection by General Contractor. Kitchen Equipment Contractor will provide certified installation, inspection, and compliance certification for the entire system.

By Others: Installation, ductwork, patching, all electrical field wiring, start-up & balance, gas or electric shutdown for fire system hook-up.
Note: Customer is responsible for additional labor charges as a result of cooking equipment layout changes after the release of the order, union labor or prevailing wage charges, or additional trips by fire system distributor caused by jobsite delays, permits, fees or test required by local authority. Submittal will specify applicable testing and approval agencies.

Captive Aire Systems requirement for all field hook ups: All fire system detection conduit must be half inch EMT. All conduit fittings must be compression type and fully tightened. All conduit ends must be reamed and deburred and blown clear of debris prior to assembly. All conduit must be fully and robustly supported to avoid accidental fire system discharge.

Captive Aire Detailed Specification:

Hood #2 - Item 36 - Job #3701313
4830VHB-G-ND - 4ft 0" Long Condensate Hood, w/ Full Perimeter Gutter, w/ND Style Front. x1
- 430 SS - 100% Application x1
- EXHAUST RISER - Factory installed 10" Diameter X 4" Height x1
- Face Mount 1st Switch x1

Fan #4 DU12HFA - Exhaust Fan (EF-3) - Job #3701313
DU12HFA High Speed Direct Drive Centrifugal Upblast Exhaust Fan with speed control (speed control included for single phase only), disconnect switch and 10-1/2" wheel.
Exhaust Fan handles 600 CFM @ -0.250" wc ESP, Fan runs at 1282 RPM.
Exhaust Motor: 0.250 HP, 1 Phs, 115 V, 60Hz, 3.7 FLA, ODP-ECM (Open Drip Proof Electronically Commutated Motor) x1
- ECM Wiring Package and Manual or 0-10VDC Control for Exhaust EC motors. RTC Controller (No harness when ordered as a part). x1
- EF-3 Curb CRB17.5x26E On Fan #4 Flat Curb x1
- Hinged Base for Curb. Standard Hinge attached to curb. Used on Fans with wheels 20 inches or smaller. 12 GA Galvanized. x1
- Vented Base for Curb x1

Duct Run #2 – Item 36
(P1) DW1045ASY Single Wall Duct 45 Degree Elbow, 10" Duct, Assembly. x1
(P2) DW1045ASY Single Wall Duct 45 Degree Elbow, 10" Duct, Assembly. x1
(P3) DW1029LT Single Wall Duct 10" diameter, 29" long, flange at both ends. Stainless Steel. x1

(P4) DW1048AJDKIT Single Wall Duct Adjustable, 10" diameter, 47.5" long, flange at one end with a 10" Adjustable Collar - Stainless Steel. x1
(P5) DW1029LT Single Wall Duct 10" diameter, 29" long, flange at both ends. Stainless Steel. x1
(P6) DW1710TPDBEX Duct to Curb Transition 3/4" Down Turn, 17-1/2" Curb to 10" Duct, 16 GA Aluminized. For Use with Exhaust Fans. x1
3M-2000PLUS Duct - 3M Fire Barrier 2000 Plus Silicone - Used as sealant to Seal Duct Joints. x1
DW10CLASY Duct "V" Clamp With new design 14 Ga Brackets, 10" Duct, Assembly. x5

Factory Services
Service Design Verification Building Surcharge x1
Service Design Verification for CASLink Ethernet. x1
Service Design Verification for Demand Control Ventilation x1
Service Design Verification for Direct Fired Heater x1
Service Design Verification for Exhaust Fan x3
Service Design Verification for Hood x2
Service Design Verification for Modular Package Unit x1
Service Design Verification Mileage Charge: (133) x 2 = 266 total miles x1
Installation, Hookup, Shipping, and Taxes Included

SERVICE DESIGN VERIFICATION DISCLAIMER
Field Service Technician is responsible for one trip to site to ensure the above equipment is operating within design specifications. All equipment must be operational. Fire suppression system should be hooked-up and armed. Additional trips will result in charges to be covered by others.

INSTALLATION BY OTHERS
- By Others: Installation, ductwork, patching, all electrical field wiring, start-up & balance, gas or electric shutdown for fire system hook-up.
- Note: Customer is responsible for additional labor charges as a result of cooking equipment layout changes after the release of the order, union labor or prevailing wage charges, or additional trips by fire system distributor caused by jobsite delays, permits, fees or test required by local authority. Submittal will specify applicable testing and approval agencies.
- **CaptiveAire Systems requirement for all field hook ups:** All fire system detection conduit must be half inch EMT. All conduit fittings must be compression type and fully tightened. All conduit ends must be reamed and deburred and blown clear of debris prior to assembly. All conduit must be fully and robustly supported to avoid accidental fire system discharge.
- CaptiveAire Systems product must be installed in accordance with installation instructions provided with equipment or available on our web site at www.captiveaire.com.
- Ductwork must be designed and installed in accordance with AMCA and ASHRAE standards as presented in CaptiveAire Systems "Guide to Designing Air Flow Systems"

SHIPPING
Freight includes one shipment only, delivered to the job site address listed on this proposal. Customer is responsible for freight charges on any items shipped early. This is an estimated freight charge and is subject to change based on current freight costs when the job is released for production.

Field measurement post demolition must be done prior to final submittal/shop drawings and manufacture. All Hoods must be coordinated with Architect and MEP prior to manufacture. Operational training shall be provided upon final installation.
(Equal Alternate Manufacturer [must match specification]: Accurex)

Item #37 **Provide (1) Corner Dish Machine, Moyer Diebel, Model #MD2000HT:**
Dishwasher, door type, 31-7/8"W, high temperature sanitizing with built-in booster heater (40°F & 70°F rise), straight-thru design (convertible from straight to corner operation in field), approximately (55) racks/hour capacity, 17" door opening, door activated start, automatic tank fill, low water tank heat protection, rinse sentry feature, automatic drain valve, top mounted splash proof controls, single point connection, self-draining pump, 1 HP pump, NSF, cULus, ENERGY STAR®, 208v/60/1ph. Complete Assembly and Installation by Kitchen Equipment Contractor. Position at location per plans. Plumbing connection by General Contractor.

Item #38 **Provide (1) SS Clean Table with Integral with #39, Custom, Aero, John Boos, or Approved Fabricator:**
Custom Clean Dishtable will be size and shape per plans and be constructed of 16/304 Stainless-Steel, with all seams welded, ground smooth, and polished. 3CD-L-144 Delux™ Clean Dishtable, straight design, 144"W x 30"D x 40"H, right-to-left operation, 16/304 stainless steel top, 7"H backsplash with 2" sanitary return, raised rolled edges on front & side, fully welded stainless steel gussets, 16/304 stainless steel legs & adjustable crossbracing, adjustable stainless steel feet, Aero Hemmed Safety Edge™, KD, NSF. 3CD-L-78 Delux™ Clean Dishtable, straight design, 78"W x 30"D x 40"H, right-to-left operation, 16/304 stainless steel top, 7"H backsplash with 2" sanitary return, raised rolled edges on front & side, fully welded stainless steel gussets, 16/304 stainless steel legs & adjustable crossbracing, adjustable stainless steel feet, Aero Hemmed Safety Edge™, KD, NSF. 3 - T-104 Weld-In Sink, one compartment, 24" x 24" x 14" deep, complete with basket & deck mount gooseneck faucet, NSF and 3 S-19 Lever Support Brackets. D-28/16GA Field Joint, specify bolt or welded, 16 gauge 300 series stainless steel and T-138 Welded set-up. Field measurement is required for this item by installer/manufacturer. Clean table will be integral with 3-Compartment Sink and Dish Machine. Custom Manufacturer will provide fabrication/submittal drawings for approval by Architect and Consultant prior to manufacture. K.E.C. to coordinate installation based on plans and place in position shown on plan. Plumbing connections by General Contractor.
(*Equal Alternate Manufacturers [must match specification]: Aero, IMC Teddy, Eagle, Advanced Tabco)*

Item #39 **Provide (1) SS Integral 3-Compartment Corner Sink with Faucets and Clean Table, Custom Aero or Approved Fabricator (included with #38):**
Custom 3-compartment sink will be size and shape per plans and constructed of 16 Gauge Type 300 Stainless-Steel with # 4 polish, satin finish, 14" Deep Bowls. Three T-104 Weld-In Sink, one compartment, 24" x 24" x 14" deep sinks will be included in the custom fabrication #38 (above), complete with basket & 2 deck mount gooseneck faucet, NSF and 3 S-19 Lever Support Brackets. 3-Compartment Sink will be integral with Dish Machine and Clean Table. Custom Manufacturer will provide fabrication/submittal drawings for approval by Architect and Consultant prior to manufacture. K.E.C. to coordinate installation based on plans and place in position shown on plan. Plumbing connections by General Contractor.
(*Equal Alternate Manufacturers [must match specification]: Aero, IMC Teddy, Eagle, Advanced Tabco)*

Item #39A **Provide (2) Service Faucet, Aero, Model #S-02:**
Stainless-Steel 12", 8" OC (T&S) service faucet will be provided and mounted on sink within #39. Complete Assembly and Installation by Kitchen Equipment Contractor. Position at location per plans. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Eagle, T&S, Elkay, Advanced Tabco)

Item #40 **Provide (1) SS Soiled Dish Table Integral with #38/39 (included with #38), Custom Aero or Approved Fabricator:**
Custom Soiled Dishtable will be size and shape as per plans and be constructed of 16/304 Stainless-Steel with all seams welded, ground smooth, and polished. 7"H backsplash with 2" sanitary return, raised rolled edges on front & side, fully welded stainless steel gussets, 16/304 stainless steel legs & adjustable crossbracing, adjustable stainless steel feet, Aero Hemmed Safety Edge™, KD, NSF. Field measurement is required for this item by installer/manufacturer. Table will be integral with custom fabrication. Custom Manufacturer will

provide fabrication/submittal drawings for approval by Architect and Consultant prior to manufacture. K.E.C. to coordinate installation based on plans and place in position shown on plan. Plumbing connections by General Contractor.
(*Equal Alternate Manufacturers [must match specification]: IMC Teddy, Eagle, John Boos)*

Item #41 **Provide (1) SS Over Shelf - Wall Mount, Aero, Model #3W-1236:**
Wall Shelf measures 36"W x 12"D. Shelf is made with 16 gauge, 304 Series stainless steel that has a 1-1/2" lip on 3 sides with a 3/4" radius front roll. Stainless steel brackets are easily mounted to welded studs. Top is polished to a #4 mill finish. NSF® Listed. Complete Assembly and Installation by Kitchen Equipment Contractor. Position at height approved per owner at location per plans. (*Equal Alternate Manufacturers [must match specification]: John Boos, IMC Teddy)*

Item #42 **Provide (2) SS Utility Cart, Metro, Model #MW204:**
30" long x 18" wide MW series Super Erecta open base utility cart from Metro has 3 solid shelves of stainless steel in a tubular stainless steel frame with push handles on each end. The flat stainless steel shelves have a raised ship's edge for easy cleaning of any liquid spills. The Super Erecta open base utility cart rolls smoothly on 4" swivel stem casters with resilient rubber wheels. K.E.C. to fully assemble and place in position per owner's instruction.
(Equal Alternate Manufacturers [must match specification]: Lakeside)

Item #43 **(1) Custom Millwork with Storage - Counter Height (34") - By Architect.**
Refer to Drawings for location.

Item #44 **(1) Custom Millwork with Storage - Counter Height (34") - By Architect.**
Refer to Drawings for location.

Item #45 **(1) Custom Millwork with Storage and Hand Sink with Splash Guards and Faucet - By Architect.**
Refer to Drawings for location. Plumbing connection by General Contractor.

Item #45A **Provide (1) Drop-in Hand Sink with Splash Guards and Faucet, Eagle, Model #HSA-10-FTWS-LRS:**
This item will be installed in custom millwork #48. Heavy gauge type 304 stainless steel all-welded construction. Inverted V" edge rim retards spillage. Unique deep-drawn positive-drain bowl assures complete drainage to meet the most stringent health code requirements. Water inlet: 1/2" NPT. Drain outlet: 1 1/2" NPS. 16 gauge type 304 stainless steel. Tapered and rounded for safety. 14 3/4" x 18 7/8" x 12 3/4" hand sink with side splashes, includes; faucet, p-trap, tubular wall brackets, basket drain, 9 3/4" x 13 1/2" x 6 3/4" bowl size. Refer to Drawings for location of each item. K.E.C. to fully assemble and place in position shown on plan. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Aero, IMC Teddy)

Item #46 **Provide (1) SS Mobile Exhibition/Demonstration Table with Attached Mirror, Advanced Tabco, Model #VSS-DT-365:**
Top is furnished with a 2" x 1" square die embossed NO-DRIP countertop edge with a 1/2" return on 4 sides. Pre-engineered welded angle adapters insure ease of future drawer installation. 36" wide table supplied with THREE hat channels stud welded to reinforce and maintain a level working surface. Aluminum die cast "leg-to-shelf" clamp secures shelf to leg eliminating unsightly nuts and bolts. Undershelf is adjustable. Fully adjustable glass mirror tilts to desired position. Locking Knob for securing mirror's position. All TIG welded. Exposed weld areas polished to match adjacent surfaces. Entire top mechanically polished to a satin finish. Countertop edge polished to a MIRROR finish. Square tubular mirror frame is 18-gauge, 304 type Stainless steel. Top is sound deadened. Roll formed embossed galvanized hat channels are secured to top by means of structural adhesive and weld studs. Unit shall measure 36" W x 60" L. Include mounted on NSF approved 5" diameter swivel casters,

two with locks, in lieu of adjustable feet. Table shall be NSF certified. Refer to Drawings for location of each item. K.E.C. to fully assemble and place in position shown on plan.
(Equal Alternate Manufacturers [must match specification]: Aero, IMC Teddy)

Item #47 **Provide (8) Lockers, Safco, Model #5523GR:**
There will be 8 total double-stacked locker units with 16 total compartments. One-piece unibody design, heavy-gauge, all-steel construction. Stand alone or link together. Recessed handle with padlock provision (padlock not included), Unit comes fully assembled. Refer to Drawings for location of each item. K.E.C. to fully assemble and place in position shown on plan.
(Equal Alternate Manufacturer [must match specification]: Uline)

Item #48 **(1) Custom Lower Millwork with Hand Sink with Splash Guards and Faucet - By Architect.**
Refer to Drawings for location. Plumbing connection by General Contractor.

Item #48A **Provide (1) Drop-in Hand Sink with Splash Guards and Faucet, Eagle, Model #HSA-10-FTWS-LRS:**
This item will be installed in custom millwork #48. Heavy gauge type 304 stainless steel all-welded construction. Inverted V" edge rim retards spillage. Unique deep-drawn positive-drain bowl assures complete drainage to meet the most stringent health code requirements. Water inlet: 1/2" NPT. Drain outlet: 1 1/2" NPS. 16 gauge type 304 stainless steel. Tapered and rounded for safety. 14 3/4" x 18 7/8" x 12 3/4" hand sink with side splashes, includes; faucet, p-trap, tubular wall brackets, basket drain, 9 3/4" x 13 1/2" x 6 3/4" bowl size. Refer to Drawings for location of each item. K.E.C. to fully assemble and place in position shown on plan. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Aero, IMC Teddy)

Item #49 **(1) Custom Upper Millwork - By Architect.**
Refer to Drawings for location.

Item #50 **(1) Desk - By Architect.**
Refer to Drawings for location.

Item #50A **(1) Chair - By Architect.**
Refer to Drawings for location.

Item #51 **(1) Custom Upper Millwork - By Architect.**
Refer to Drawings for location.

Item #52 **Provide (LOT) Dry Storage Shelving, Metro Super Erecta Shelving, Model # (8) 2436NS SHELVES, (16) 2448NS SHELVES, (24) 74P POSTS:**
6 total shelving units – 2 measuring 24” x 36” and 4 measuring 24” x 48” – shall be supplied with 4 adjustable shelves per unit. Super Erecta shelves and posts are constructed of heavy-gauge Type 304 Stainless-Steel. Finish will be polished Stainless-Steel for dry storage. SiteSelect™ Posts have a double groove visual guide feature every 8" (203mm), circular grooves at 1" (25mm) increments, and are numbered at 2" (50mm) intervals. A patented, tapered split sleeve snaps together around each post. Tapered openings in the shelf corners slide over the tapered split sleeves providing a positive lock. Shelves can be adjusted at 1" (25mm) intervals along the entire length of the post. Unit comes with adjustable Feet which can be substituted with casters. K.E.C. to assemble and place in positions shown on plan. Shelves and Posts shall be in sizes listed below:

(8) 2436NS SHELVES
(16) 2448NS SHELVES
(24) 74P POSTS

(Equal Alternate Manufacturers [must match specification]: Eagle, Technibilt, New Age, Channel)

Item #52A **Provide (1) Can Rack, New Age, Model #1256:**
Can Storage Rack, stationary design with adjustable feet, sloped glides for automatic can retrieval, aluminum construction, holds 216-#10 or 297-#5 cans, NSF. All welded (6063-T5) type alloy construction consisting of heavy-duty tubing uprights and cross braces with can guides of "T" and angle. Vertical corner uprights are constructed of 1-¼" x 1-½" x .070" wall extruded aluminum tubing to which horizontal cross braces of 1" x 1" x .070 wall aluminum tubing are welded. Guides are constructed of 1-¼" x 1-¼" x .100 thick angle and 1-¼" x 2-¼" x .100 thick "T" with front and rear edges turned up ¾". The guides are welded to the cross braces on 7-3/8" centers; the rear of each guide is positioned 1" higher than the front to allow cans to roll forward. Stationary racks are mounted on four threaded stem type adjustable feet. Refer to Drawings for location. K.E.C. to fully assemble and place in position shown on plan.
(Equal Alternate Manufacturers [must match specification]: Channel, Advanced Tabco)

Item #52B **Provide (1) Dunnage Rack (Not Shown), New Age, Model #2005:**
Dunnage Rack, tubular aluminum square bar construction, 1-tier, 24"W x 36"L x 8"H, weight capacity 2500 lbs., all welded aluminum construction, NSF. Height: 8.00", Width: 36.00", Depth: 24.00", Weight: 14.00 lbs. Refer to owner for direction on location of this item. K.E.C. to fully assemble and place in position per owner.
(Equal Alternate Manufacturers [must match specification]: Metro, Channel, Advanced Tabco, Eagle)

Item #53 **Provide (1) Mop Sink with Service Faucet, Hose, Bracket, and Mop Hanger, Eagle, Model #F2820-12:**
Mop Sink, floor mount, 304 Stainless-Steel construction, 20" Wide x 28" front-to-back x 20" deep bowl, 16-gauge top with "V" edge, full skirt, 2" NPS nickel-plated cast bronze drain with Stainless-Steel removable Snap-On flat strainer plate, NSF. Mop sink to include accessories: model #312688, Model #312689 and Model #312690. K.E.C to fully assemble, place in position shown on plans, and provide to Contractor for final installation. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Aero, IMC Teddy, John Boos, Advanced Tabco)

Item #53A **Provide (1) Mop Holder, (1) Hose and Bracket, and (1) Service Faucet, Eagle, Model #312688, #312689, and #312690:**
Mop Holder, Model #312688 will hold 3 mops and shall be wall mounted at height per operator's discretion. Hose and Bracket, Model #312689 shall be 30" in length and weighs 8 lbs. The Service Faucet, Model #312690 is 8" center, ½" NPT female inlets, comes with vacuum breaker. Refer to Drawings for location of each item. K.E.C. to fully assemble and place in position shown on plan. Plumbing connection by General Contractor.
(Equal Alternate Manufacturers [must match specification]: Aero, IMC Teddy)

Item #54 **(1) Clothes Washer – By Owner.**
Refer to Drawings for location. Plumbing connection by General Contractor.

Item #55 **(1) Clothes Dryer – By Owner.**
Refer to Drawings for location. Plumbing connection by General Contractor.

Item #56 **(1) Hot Water Heater - By Architect.**
Refer to Drawings for location. Plumbing connection by General Contractor.

Item #57 **Provide (24) Classroom/Cafe Chairs, ATC Furniture, Model - Fleet SC Chair:**
Armless Slat Back Aluminum Chair features a slat style back and a sturdy welded aluminum frame. Dimensions: 15 1/2"W x 14"D x 33"H. Information at https://www.amtradeco.com.

Item #58 **Provide (24) All Weather/Outside Patio Chairs, ATC Furniture, Model – Toledo AC Chair:**
Aluminum chair boasts a simple, but trendy, metallic design. Its frame features sleek curves and smooth lines, made of shiny aluminum for a touch of luster. The back and seat are also aluminum and are slatted for air flow and user comfort. Dimensions: 17 1/2"W x 15 1/2"D x 33"H. Information at https://www.amtradeco.com.

Item #59 **Provide (6) Classroom/Café Tables (Tops and Bases), ATC Furniture, Model – 32" x 48" Werzalit Top and Jennifer Rectangle (ADA Compliant) Base:**
32" x 48" Werzalit Rectangle Table Top (Stock Color to be determined/chosen by Architect/Client) with pedestal base (Jennifer Rectangle-ADA Compliant Polished Base – Aluminum). Information at https://www.amtradeco.com; https://www.amtradeco.com/table-tops/in-stock. Werzalit tabletops are seamless, weather-resistant molded laminate table tops.

Item #60 **Provide (6) All Weather Patio Tables (Tops and Bases), ATC Furniture, Model – 32" Round Werzalit Top and Jennifer 3 Base:**
32" Round Werzalit Table Top (Stock Color to be determined/chosen by Architect/Client) with pedestal base (Jennifer 3 Polished Base – Aluminum). Information at https://www.amtradeco.com; https://www.amtradeco.com/table-tops/in-stock. Werzalit tabletops are seamless, weather-resistant molded laminate table tops.

Item #61 **Provide (LOT) SS Wall Cladding, Custom, Texas Sheet Metal or Approved Fabricator:**
(Lot #1) Stainless-Steel wall cladding will be installed behind the Cook Line as shown on plan from the cove base to the bottom of the exhaust hood. Fabricator to include all hardware, seams and installation materials. Exact dimensions are the responsibility of the K.E.C. and Fabricator prior to installation. Refer to Drawings for location of each item. K.E.C. to fully assemble and place in position shown on plan. Field Measurement and approved submittal drawings (by Food Service Consultant, Owner, and Architect) are required on this item before manufacturer.

Item #62 **Provide (LOT) Corner Guards (Not Shown), New Age, Model #97874:**
These aluminum corner guards are designed to help keep your corners protected. These all aluminum corner guards are a less expensive alternative to Stainless-Steel. Corner guards are constructed out of .080" thick aluminum sheet. All aluminum 2" x 2"x 48" in length, corner guards to be installed by Kitchen Equipment Contractor on all exposed corners, as shown on plan. These corner guards carry a Lifetime Guarantee against rust and corrosion and carry a Five-Year Guarantee against workmanship and material defects. K.E.C. to fully assemble and place in in position on all exposed corners within kitchen and service area.
(Equal Alternate Manufacturers [must match specification]: Aero, Texas Sheet Metal)

Item #63 **Provide (2) Speed Racks (Not Shown), New Age, Model #4331:**
These racks are built specifically for roll-in freezers, proofers, refrigerators, and retarders. Heavy-duty construction is built for the long haul. Angle runners are not adjustable. Uprights are constructed out of 1-1/2" x 1-3/4" .070" wall D-Tube. Angle runners are 1-1/2"x 3-1/4"x .100" wall on the wide-angle racks and angle runners are 2"x 6-3/16" x.100" wall on the stepped angle racks. These racks come equipped with four 5" platform type swivel casters. These racks carry a Lifetime Guarantee against rust and corrosion and also carry a Lifetime Guarantee against workmanship and material defects. K.E.C to fully assemble, place in position shown, and provide to Contractor for final installation. Refer to plans for location of item. Electrical connection by General Contractor. K.E.C. to fully assemble and place in position per owner/operator direction.
(Equal Alternate Manufacturers [must match specification]: - Aero, Channel, Advanced Tabco)

Item #64 **(1) Tea Brewer - By Vendor/Owner.**
Refer to Drawings for location of each item. Plumbing and electrical connection by General Contractor.

Item #65 **(1) Coffee Brewer - By Vendor/Owner.**
Refer to Drawings for location of each item. Plumbing and electrical connection by General Contractor.

Item #66 **Provide (1) Mobile Ice Caddy, Cambro, Model #ICS200TB:**
Cart shall be constructed of single-molded, double-wall, high density polyethylene and thick foam injected polyurethane. It shall have a sliding lid without latches. It shall slide back, under secured base lid and have rounded corners and a molded-in handle. It shall have rounded corners and molded-in handles. It shall have a 39-1/2" working height and shall be 23” W and 34” D with a 200 lb. capacity. It shall have a recessed, leakproof, quarter turn faucet in the front. It shall have a recessed interior well with one unbreakable polycarbonate shelf. Complete Assembly and Installation by Kitchen Equipment Contractor. Position at location per plans.

Item #67 **(1) Teacher Presentation/Monitor (Wall Mounted) – By Architect.**
Refer to Drawings for location. Electrical and internet connection by General Contractor.

Item #68 **(1) Floor to Ceiling Storage Millwork - By Architect.**
Refer to Drawings for location.

Item #69 **Provide (1) Refrigerated Counter Top Merchandiser, Turbo Air, Model #TGM-7SD:**
TGM-7SD ENERGY STAR rated Super Deluxe series rear mount insulated glass door merchandiser refrigerator runs on 115 Volts, 60 Hz, 1-phase and 3.5 Amps for 1/7 HP and comes with a 9 ft power cord with a NEMA 5-15P plug. 25" wide, White interior, Rear mount compressor, Capacity: 7.6 cubic feet, Adjustable PE (polyethylene) coated wire shelves, Self-contained refrigeration and holds at 33-38 degrees F. Complete Assembly and Installation by Kitchen Equipment Contractor. Position at location per plans. Electrical connection by General Contractor.

Item #70 **(1) POS System – By Owner.**
Refer to Drawings for location. Electrical and internet connection by General Contractor.

SECTION 11400.5.02 SMALLWARES SPECIFICATIONS - DETAILED:

SECTION 11400.5.02 **SMALLWARES SPECIFICATIONS – DETAILED (BY ITEM):**

Item #S1 **Provide (18) Full Sheet Pans, Carlisle, Model #601826:**
Sheet Pan, full size, 25-3/4"L x 17-13/16"W x 1-1/8" deep, seamless, non-perforated, rolled-edge, galvanized steel wire reinforced bead, tapered, stackable, heavy-duty, 16 gauge tempered aluminum.

Item #S2 **Provide (12) Half Sheet Pans, Carlisle, Model #601824:**
Bun Pan, half size, 17-13/16"L x 12-7/8"W x 1" deep, seamless, non- perforated, rolled-edge, galvanized steel wire reinforced bead, tapered, stackable, heavy-duty, 18 gauge tempered aluminum.

Item #S3 **Provide (9) Bus Tubs, Carlisle, Model #4401103:**
Comfort Curve™ Bus Box, 1 compartment, 20"L x 15"W x 7"H, reinforced rims, stackable, Comfort Curve™ handles, dishwasher safe, high density polyethylene, black, NSF.

Item #S4 **Provide (9) Dough Cutter, Mercer Culinary, Model #M18810P:**
Mercer Cutlery Bench Scraper, 6" x 3", stain-resistant steel blade, black molded slip-resistant polypropylene handle, with self-adhesive hang tab label.

Item #S5 **Provide (9) Bowl Scrapper, Alegacy Foodservice Products, Model #FS8446:**
Bowl Scraper, 5-3/4" x 3-1/2", flexible plastic, white.

Item #S6 **Provide (6) Pastry Brush, Carlisle, Model #4037500:**
Sparta® Chef Series™ Basting Brush, 3" wide epoxy-set bristles, double-boiled, heat resistant up to 500°F, water-resistant, brown plastic ferrules, lacquered hardwood handle, boar's hair, bleached.

Item #S7 **Provide (9) 8" Chef Knife, Mercer Culinary, Model #M22608WBH:**
Millennia® Color Handles Chef's Knife, 8", stamped, high carbon, Japanese stain-resistant steel, white non-slip Santoprene® & polypropylene handle, with textured finger points and protective finger guard, NSF.

Item #S8 **Provide (9) 7" Santoku, Mercer Culinary, Model #M22707WBH:**
Millennia® Color Handles Santoku Knife, 7", granton edge, stamped, high carbon, Japanese stain-resistant steel, white non-slip Santoprene® & polypropylene handle, with textured finger points and protective finger guard, NSF.

Item #S9 **Provide (9) 6" Boning Knife, Mercer Culinary, Model #M18100:**
Ultimate White® Boning Knife, 6", stiff, stamped, high carbon, stain- resistant steel, ergonomic white handle, with textured finger points and protective finger guard, NSF.

Item #S10 **Provide (9) 3" Paring Knife, Mercer Culinary, Model #M23930WBH:**
Color Handles Paring Knife, 3", stamped, high carbon, Japanese stain-resistant steel, white non-slip Santoprene® & polypropylene handle, with textured finger points and protective finger guard, NSF.

Item #S11 **Provide (9) 8" Bread Knife, Mercer Culinary, Model #M23890WBH:**
8-9", offset, wavy edge, stamped, high carbon, Japanese stain-resistant steel, white non-slip Santoprene® & polypropylene handle, with textured finger points and protective finger guard, NSF.

Item #S12 **Provide (9) 8" Carving Knife, Mercer Culinary, Model #M20408:**
Genesis® Carving Knife, 8", precision forged, high carbon, no-stain, German steel, black non-slip Santoprene® handle, NSF.

Item #S13 **Provide (9) Vegetable Peelers, Mercer Culinary, Model #M33071BKB:**
Y-Peeler, 4" overall length, swivel blade, high-carbon steel, black handle.

Item #S14 **Provide (6) Knife Steel, Mercer Culinary, Model #M14412:**
Mercer Cutlery Ceramic Sharpener, 12", with hanging ring, black nylon handle.

Item #S15 **Provide 12 Cutting Board – White, San Jamar, Model #CBG182412WH:**
Saf-T-Grip® Cutting Board, 18" x 24" x 1/2", anti-slip grip corners, food safety hook, integrated ruler, dishwasher safe, co-polymer, white, NSF.

Item #S16 **Provide (9) Measuring Spoons (sets), Alegacy Foodservice Products, Model #2314:**
Measuring Spoon Set, includes: (1) 1/4, (1) 1/3, (1) 1 tsp & (1) 1 tbsp, bowl style, aluminum.

Item #S17 **Provide (9) Measuring Cups (sets), Alegacy Foodservice Products, Model #1191MC:**
Measuring Cup Set, includes: (1) 1/4, (1) 1/3, (1) 1/2, & (1) 1 cup, round, wire handle, stainless steel.

Item #S18 **Provide (9) Large Measuring Cups (4 cup), Carlisle, Model #4314307:**
Measuring Cup, 32 oz. (1 qt.) capacity, oval, pour spout nestable, US/Metric measurements, C-handle, dishwasher safe, polycarbonate, Clear, NSF.

Item #S19 **Provide 12 Bread Pans, Carlisle, Model #604144:**
Steeluminum® Bread Pan, 53.6 fl. oz. capacity, makes 1 lb. loaf, corrosion resistant, Bake Prep® Plus finish, aluminized steel.

Item #S20 **Provide (6) 8" Cake Pans, Crown Brands, LLC, Model #63408:**
Johnson-Rose™ - Cake/Deep Dish Pan, 8" dia. x 2"H, round, straight sided with a beaded edge, 18 gauge, 1.02 mm thickness, 1100 aluminum.

Item #S21 **Provide (6) 12 Cup Muffin Pans, Carlisle, Model #601830:**
Steeluminum® Cupcake Pan, 12 cup, 3-1/2 oz, 14"L x 10-5/8"W, heavy- duty, corrosion resistant, seamless cups, Bake Prep® Plus finish, aluminized steel.

Item #S22A **Provide (2) Cake Decorating Sets, Crown Brands LLC, Model #783 - Cake Decorating Set, 55 pieces:**
Johnson-Rose™ - Cake Decorating Set, 55 pieces.

Item #S22B **Provide (2) Cake Decorating Sets, Crown Brands, LLC, Model #CDTS-24 - Cake Decorating Tube Set, includes 24 assorted tubes, with plastic storage box and lid:**
Update International™ - Cake Decorating Tube Set, includes 24 assorted tubes, with plastic storage box and lid.

Item #S22C **Provide (3) Pastry Bag, Crown Brands, LLC, Model #PB-16PC:**
Pastry Bag, 16", plastic coated canvas.

Item #S22D **Provide (3) Pastry Bag, Crown Brands, LLC, Model #PB-14PC:**
Pastry Bag, 14", plastic coated canvas.

Item #S23 **Provide (6) 8" Strainers, Carlisle, Model #601529:**

Mesh Skimmer, 9" dia. bowl, 24" long, corrosion-resistant, hanging loop, dishwasher safe, heavy-duty, chrome-plated nickel steel.

Item #S24 **Provide (3) Colander, Carlisle, Model #60278:**
Colander, 8 qt., 12" dia. x 5" deep, rolled top edge, seamless, footed, riveted loop handles, dishwasher safe, standard-weight, aluminum, satin finish.

Item #S25 **Provide (6) Rolling Pins – PolyRoll, San Jamar, Model #RP18:**
Poly-Roll® Rolling Pin, 18", polyethylene, NSF.

Item #S26 **Provide (6) 2.5 Qt Sauce Pan, Carlisle, Model #61702/61702C:**
Sauce Pan, 2-1/2 qt., standard weight, tapered, riveted handle with removable Dura-Kool™ silicone sleeve, reinforced beadless rim, double thick base, 3003 aluminum, satin finish, NSF.

61702C Cover, 8" dia., flat, heavy-duty, dent and warp resistant, riveted open looped handles, 3004 aluminum, NSF, (fits model #61702).

Item #S27 **Provide (6) 4.5 Qt Sauce Pan, Carlisle, Model #61704/61704C:**
Sauce Pan, 4-1/2 qt., standard weight, tapered, riveted handle with removable Dura-Kool™ silicone sleeve, reinforced beadless rim, double thick base, 3003 aluminum, satin finish, NSF.

61704C Cover, 9" dia., flat, heavy-duty, dent and warp resistant, riveted open looped handles, 3004 aluminum, NSF, (fits model #61704).

Item #S28 **Provide (6) 6 Qt Sauce Pan, Carlisle, Model #61707/61707C:**
Sauce Pan, 6 qt., standard weight, tapered, riveted handle with removable Dura-Kool™ silicone sleeve, reinforced beadless rim, double thick base, 3003 aluminum, satin finish, NSF.

61707C Cover, 11" dia., flat, heavy-duty, dent and warp resistant, riveted open looped handles, 3004 aluminum, NSF, (fits model #61707).

Item #S29 **Provide (6) 7” Sauté Pans, Carlisle, Model #60907SERS:**
Teflon Select® Fry Pan, 7" dia., removable Dura-Kool™ silicone sleeve, extra-smooth non-stick surface, abrasion-resistant, riveted handle, 3004 aluminum, NSF.

Item #S30 **Provide (6) 10” Sauté Pans, Carlisle, Model #60910XRS:**
Excalibur® Fry Pan, 10" dia., removable Dura-Kool™ silicone sleeve, scratch-resistant, stainless steel reinforced non-stick coating, dishwasher safe, riveted handle, 3004 aluminum, NSF.

Item #S31 **Provide (6) 10 Qt Stock Pots, Carlisle, Model #61210/61210C:**
Stock Pot, 10 qt., standard weight, loop handles, reinforced beadless rim, double thick base, 3003 aluminum, satin finish, NSF.

61210C Cover, 10" dia., flat, heavy-duty, dent and warp resistant, riveted open looped handles, 3004 aluminum, NSF, (fits models #61210 & 61212).

Item #S32 **Provide (3) 12 Qt Rondeau/Brazier, Carlisle, Model #61115/61224C:**
Brazier Pan, 15 qt., standard weight, riveted two-sided loop handles, double thick top edge and base, aluminum, satin finish, NSF.

61224C Cover, 13-1/2" dia., flat, heavy-duty, dent and warp resistant, riveted open looped handles, 3004 aluminum, NSF, (fits model #61224).

Item #S33 **Provide (3) Set of Stainless Bowls, Tovolo, Model #81-1947C 1.5 qt, 3 qt, 5 qt SS Mixing Bowls:**
This essential Stainless Steel Mixing Bowl set nests for easy storage. The set also includes tight-seal lids. Set includes one of each size (1.5 quart, 3 quart and 5 quart). Stainless steel constructed bowls with Measurements stamped on interior.

Item #S34 **Provide (3) Set of Stainless Bowls, Choice, SS Mixing Bowl Set with Silicone Non-Slip Bases (Set of 5), Model #176MBSLCSET5:**
Constructed of stainless steel with a 0.4mm to 0.5mm thickness, these bowls are meant to stand up to any task. From simply whisking dressings and tossing salads to kneading heavy dough for a pizza, these mixing bowls can withstand it all. With a large, wide rim it is easy to hold and handle during use. Set Includes: 1 - 0.75 qt. mixing bowl, 1 - 1.5 qt. mixing bowl, 1- 3 qt. mixing bowl, 1 - 5 qt. mixing bowl, and 1 - 8 qt. mixing bowl.

Item #S35 **Provide (6) 8" China Cap, Crestware, Model #CCS8F:**
Cap Strainer, 8", fine, 18/8 stainless steel.

Item #S36 **Provide (6) Off Set Spatulas, Mercer Culinary, Model #M18820P:**
Mercer Cutlery Spatula, 8"L x 1-3/8"W blade, offset, tapered ground stain-resistant stainless steel blade, molded slip-resistant black polypropylene handle, self-adhesive hang tab label, dishwasher safe, NSF.

Item #S37 **Provide (12) Serving Spoons/Solid, Walco Stainless, Model #UL-012:**
Ultra™ Buffetware Serving Spoon, 10-1/2", solid, 18/10 stainless steel.

Item #S38 **Provide (12) Serving Spoons/Slotted, Walco Stainless, Model #UL-126:**
Ultra™ Buffetware Serving Spoon, 13-1/8", long handle, slotted, 18/10 stainless steel.

Item #S39 **Provide (9) 8" Wire Whisk, Crestware, Model #PW8:**
Piano Whip, 8" flexible wire, 18/8 stainless steel, sealed ends.

Item #S40 **Provide (3) Ladles (1 oz), Crestware, Model #CL01:**
Ladle, 1 oz., 11-1/2", black silicone handle.

Item #S41 **Provide (3) Ladles (2 oz), Crestware, Model #CL02:**
Ladle, 2 oz., 11-1/2", blue silicone handle.

Item #S42 **Provide (3) Ladles (4 oz), Crestware, Model #CL04:**
Ladle, 4 oz., 14", gray silicone handle.

Item #S43 **Provide (3) Ladles (6 oz), Crestware, Model #CL06:**
Ladle, 6 oz., 14-1/2", teal silicone handle.

Item #S44B **Provide (6) Metal Tongs - 9.5", Carlisle, Model #60756003:**
Spectrum® Utility Tongs, 9-1/2" long, one-piece, color-coded Dura- Kool™ vinyl handle, scalloped edges, spring action hinge, dishwasher safe, stainless steel, black, NSF.

Item #S44A **Provide (3) Metal Tongs – 12", Carlisle, Model #60756203:**

Spectrum® Utility Tongs, 12" long, one-piece, color-coded Dura-Kool™ vinyl handle, scalloped edges, spring action hinge, dishwasher safe, stainless steel, black, NSF.

Item #S45 **Provide (9) Heat Resistant Rubber Spatulas, Carlisle, Model #4413202:**
Spatula, 13-7/8", tapered fine-edge, blade, hanging hole, cool-touch handle, over-molded blade/handle, high heat-resistant to 600°F, dishwasher safe, silicone, red.

Item #S46 **Provide (9) Meat Forks, Mercer Culinary, Model #M14007:**
Millennia® Cutlery Fork, 7" blade, 12-3/16 overall length, straight, stamped, high carbon, stain-resistant steel, Santoprene® & polypropylene handle, NSF.

Item #S47 **Provide (3) Roasting Pans, Carlisle, Model #60345:**
Roast Pan, 26 qt., 24"L x 18"W x 4-1/2"H, riveted drop handles, (2) steel reinforced bands, seamless drawn sanitary open bead, fabricated lugs hold top securely in place, use as base for double roaster, 16 gauge aluminum, NSF.

Item #S48 **Provide (3) 5 QT Mixers, Kitchen Aid, Model #KSM150PSSM:**
Artisan Series 5-quart mixer, 10 speed, tilt back head for easy access to mixture, 1-piece pouring shield with large chute for adding ingredients, includes flat beater, dough hook and wire whip. 325 watts, 120v/60/1ph, Silver Metallic.

Item #S49 **Provide (3) Blenders, Waring, Model #TBB145:**
Torq 2.0 Bar Blender, countertop, two speed, 48 oz. capacity stackable BPA-free co-polyester jar, vinyl lid with removable center cap, toggle switch operation, user-replaceable heavy duty stainless steel blade with solid blending assembly, heavy duty base, 2HP, 1.5kW, 15.0 amps, 120v/50/60/1-ph, cETLus, NSF.

Item #S50 **Provide (3) Hand Emulsion Mixers, Kitchen Aid, Model #KHBC308OB:**
KitchenAid KHBC308OB is a commercial immersion blender with an 8" removable arm. The stainless steel removable arm is dishwasher-safe and includes an s-shaped blade for high performance mixing and blending. The immersion blender features a quiet, yet powerful motor to handle difficult blending with ease, including dough, with a maximum blend volume of 3 gallons. The motor features (2) speeds for added versatility at 11,000 and 18,000 RPM. Lightweight for easy one-handed operation with a soft-grip handle. Wall mount included for easy storage. 350 watts. ½ HP. NSF Listed.

Item #S51 **Provide (4) Chaffing Dishes, Walco Stainless, Model #CH8QTRE:**
Champion Chafer, 8 quart, rectangular, food pan, metal cover, stand, 18/10 stainless steel.

Item #S52 **Provide (10) Full Hotel Pans, Carlisle, Model #608004:**
DuraPan™ Steam Table Pan, full size, 12.5 qt., 4" deep, reinforced corners, stackable, anti-jam, dishwasher safe, 22 gauge 18/8 stainless steel, NSF.

Item #S53 **Provide (12) 1/2 Hotel Pans, Carlisle, Model #608124:**
DuraPan™ Steam Table Pan, 1/2-size, 7 qt., 4" deep, reinforced corners, stackable, anti-jam, dishwasher safe, 22 gauge 18/8 stainless steel, NSF.

Item #S54 **Provide (12) 1/3 Hotel Pans, Carlisle, Model #608134:**
DuraPan™ Steam Table Pan, 1/3-size, 4 qt., 4" deep, reinforced corners, stackable, anti-jam, dishwasher safe, 22 gauge 18/8 stainless steel, NSF.

Item #S55 **Provide (8) Full Perforated Hotel Pans with Covers, Carlisle, Model #607002P/607000CS:**

DuraPan™ Steam Table Pan, full size, perforated, 10.4 qt., 2-1/2" deep, reinforced corners, stackable, anti-jam, dishwasher safe, 24 gauge 18/8 stainless steel, NSF.

607000CS DuraPan™ Steam Table Pan Cover, full-size, slotted, flat, lift- off, recessed handle, dishwasher safe, 24 gauge 18/8 stainless steel.

Item #S56 **Provide (12) Lidded Storage Containers, 2 QT Carlisle, Model #1072007/1074008:**
StorPlus™ Food Storage Container, 2 qt., 7-1/8" x 3-13/16"H, square, reinforced stacking lugs, secure easy-grip handles with drain holes, date indicators, color-coded capacity indicators, dishwasher safe, textured non-slip finish, polycarbonate, clear, NSF, Made in USA.

1074008 StorPlus™ Lid, 7-5/16" x 3/5"H, fits 2-4 qt. square containers, snap-on, color-coded, textured non-slip finish, scratch-resistant, dishwasher safe, polyethylene, dark green, NSF, Made in USA.

Item #S57 **Provide (12) Lidded Storage Containers, 4 QT Carlisle, Model #1072107/1074008:**
StorPlus™ Food Storage Container, 4 qt., 7-1/8" x 7-5/16"H, square, reinforced stacking lugs, secure easy-grip handles with drain holes, date indicators, color-coded capacity indicators, dishwasher safe, textured non-slip finish, polycarbonate, clear, NSF, Made in USA.

1074008 StorPlus™ Lid, 7-5/16" x 3/5"H, fits 2-4 qt. square containers, snap-on, color-coded, textured non-slip finish, scratch-resistant, dishwasher safe, polyethylene, dark green, NSF, Made in USA.

Item #S58 **Provide (12) Lidded Storage Containers, 5 QT Carlisle, Model #1072207/1074105:**
StorPlus™ Food Storage Container, 6 qt., 8-3/4" x 7-5/16"H, square, reinforced stacking lugs, secure easy-grip handles with drain holes, date indicators, color-coded capacity indicators, dishwasher safe, textured non-slip finish, polycarbonate, clear, NSF, Made in USA.

1074105 StorPlus™ Lid, 9" x 3/5"H, fits 6-8 qt. square containers, snap- on, color-coded, textured non-slip finish, scratch-resistant, dishwasher safe, polyethylene, red, NSF, Made in USA.

Item #S59 **Provide (6) Food Storage Boxes with Lids 12x18x6, Carlisle, Model #1061107/1061707:**
StorPlus™ Food Storage Box, 3-1/2 gallon, 18"L x 12"W x 6"H, reinforced corners, stackable, date & capacity indicators, easy-grip handles, break-resistant, dishwasher safe, textured non-slip finish, polycarbonate, clear, NSF, Made in USA.

1061707 StorPlus™ Food Storage Lid, 18"L x 12"W, reinforced corners, lock-tight, stackable, reversible-use as a bun pan/tray, break-resistant, date indicator, textured non-slip finish, dishwasher safe, polycarbonate, clear, NSF, Made in USA.

Item #S60 **Provide (6) Food Storage Boxes with Lids 12x18x12, Carlisle, Model #1062307/1062707:**
StorPlus™ Food Storage Box, 16.6 gallon, 26"L x 18"W x 12"H, reinforced corners, stackable, date indicators, easy-grip handles, break-resistant, dishwasher safe, textured non-slip finish, polycarbonate, clear, NSF, Made in USA.

1062707 StorPlus™ Food Storage Lid, 26"L x 18"W, reinforced corners, lock-tight, stackable, reversible-use as a bun pan/tray, break-resistant, date indicator, textured non-slip finish, dishwasher safe, polycarbonate, clear, NSF, Made in USA.

Item #S61 **Provide (6) Food Storage Boxes with Lids 18x26x6, Carlisle, Model #1062107/1062707:**

StorPlus™ Food Storage Box, 8-1/2 gallon, 26"L x 18"W x 6"H, reinforced corners, stackable, date indicators, easy-grip handles, break-resistant, dishwasher safe, textured non-slip finish, polycarbonate, clear, NSF, Made in USA.

1062707 StorPlus™ Food Storage Lid, 26"L x 18"W, reinforced corners, lock-tight, stackable, reversible-use as a bun pan/tray, break-resistant, date indicator, textured non-slip finish, dishwasher safe, polycarbonate, clear, NSF, Made in USA.

Item #S62 **Provide (6) Food Storage Boxes with Lids 18x26x12, Carlisle, Model #1061207/1061707:**
StorPlus™ Food Storage Box, 5-gallon, 18"L x 12"W x 9"H, reinforced corners, stackable, date & capacity indicators, easy-grip handles, break-resistant, dishwasher safe, textured non-slip finish, polycarbonate, clear, NSF, Made in USA.

1061707 StorPlus™ Food Storage Lid, 18"L x 12"W, reinforced corners, lock-tight, stackable, reversible-use as a bun pan/tray, break-resistant, date indicator, textured non-slip finish, dishwasher safe, polycarbonate, clear, NSF, Made in USA.

Item #S63 **(LOT) Waste/Trash Cans - By Owner.**

Item #S64 **Provide (4 cases) Glassware, Libbey, Model Acopa 14 oz. Straight Sided Beverage Glass; 12/case:**
Multi-use Beverage Glass - Height 6 Inches, Bottom Diameter 2-3/8 Inches, Top Diameter 2-7/8 Inches, Capacity 14 oz., Color – Clear, Dishwasher Safe, Glass.

Item #S65 **Provide (12 sets) China/Dish Sets, Oneida, Model #D137916R Naturally White 16pc Dinnerware Set, Service for 4:**
Oneida Naturally White dinnerware set offers simple and classic style, perfect for any table setting. Each set includes: Four 10.75-in. dinner plates, Four 8-in. salad plates, Four 7-in. bowls, and Four 14-oz. mugs. All White Porcelain. Dishwasher Safe; Includes Oneida's Limited Lifetime Warranty.

Item #S66 **Provide (4 sets) Utensils/Flatware Sets, Oneida, Model Flight 65 Piece Casual Flatware Set, Service for 12:**
Flatware is attractive and has a reflective body accented by a subtle stylized line, offering timeless design appeal that blends with any decor. Each Set Contains: (12) Dinner Knife, (12) Dinner Fork, (12) Salad Fork, (12) Dinner Spoon and (12) Teaspoon, (2) Serving Spoon, (1) Sugar Spoon, (1) Butter Knife and (1) Serving Fork. Made of Quality 18/0 Stainless Steel with a High Luster Finish. Dishwasher Safe; Includes Oneida's Limited Lifetime Warranty.

TECHNOLOGY SECTIONS

27 00 00 – GENERAL TECHNOLOGY REQUIREMENTS

PART 1 - GENERAL

1.1 Project Summary

A. Scope: Successful bidder shall provide, install, configure, and provide warranty service for technology systems described herein.

1.2 Related Documents

A. Documents: Provisions of General Conditions, Supplementary Conditions, and the sections included under Procurement & Contract Requirements are included as part of this section as though bound herein.

1.3 Related Work

A. Section 27 05 00 – Communications General Requirements

B. Section 27 05 23 – Pathways for Technology Systems

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 11 00 – Communications Equipment Rooms

E. Section 27 13 00 – Communications Backbone Cabling

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 16 00 – Communications Connecting Cords

H. Section 27 18 00 – Communications Labeling and Identification

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

1.4 Allowances

A. Contractor shall maintain project allowance for technology systems that will be procured by separate contract. The purpose is to allow technology to evaluate and make best practices decisions. Allowances are to be held and allocated at the owner's direction. Contractor shall reference Division 01 Allowances. The allowances are defined as:

1. Interactive flat panel displays, mounts, and associated accessories. Refer to specification 27 41 00.

1.5 Definitions

A. Approved or Approval: Where approval is called for, only persons with the authorized authority may grant approval. Owner reserves all rights to govern over and grant approval and will appoint authority of agents acting on their behalf.

B. As Required: Contractor shall provide the quantity of said item that is necessary. Owner and Consultant reserve the right to make the final determination of necessary quantities to provide for a complete system.

C. Basis of Design: The documentation of the concepts, calculations, decisions, and product selections used to meet the Owner's project requirements. These Consultant produced documents are not shop drawings. Product selections depict minimum functionality and overall quality and are open to substitution requests.

D. Consultant: True North Consulting G.

E. Contractor: The qualified party responsible to provide all items and perform services as described within these documents. The Contractor referred to within a specific specification section shall be the successful qualified party contracted to perform and complete that work.

F. Documents: The complete package of Bid and Contract Requirements, General Technology Requirements, related Division 27 sections, drawings, schedules, and addenda that make up this Request for Bid.

G. End-User: Individual(s) who will ultimately operate the completed system.

H. ETR: Existing to Remain. Item is to remain in current location and maintain current functionality.

I. Furnish: To supply and deliver to project site, ready for installation.

J. Install: To place in a position of service or use.

K. NIC: Not in Contract. Item will be the responsibility of others.

L. Notice to Proceed: Formal communication from Owner to Contractor stating the date the Contractor can begin work subject to the conditions of the contract. The performance time of the contract starts from the Notice to Proceed date.

M. OFCI: Owner Furnished Contractor Installed. Item will be provided by Owner and shall be installed by Contractor.

N. OFE: Owner Furnished Equipment. Item will be provided and integrated by Owner.

O. OFOI: Owner Furnished Owner Installed. Item will be provided and installed by Owner.

P. Owner: The party named in the Procurement and Contract Requirements as the advertising party.

Q. Provide: To furnish and install, complete and ready for intended use.

R. Substantial Completion: The stage in the progress of installation when the systems described herein are sufficiently complete, in accordance with the Contract Documents, so that the Owner can utilize such systems for their complete intended use.

S. Turnkey: Of or involving the provision of a complete product or service that is ready for immediate use.

T. Work: The provision of products and/or services to meet the requirements specified in these documents.

1.6 Reference Standards and Codes

A. Standards and other procedures referenced by this bid package are as follows:

1. ADA – Americans with Disabilities Act of 2010
www.ada.gov/2010ADAstandards_index.htm

2. AIA – American Institute of Architects
   www.aia.org

3. ANSI – American National Standards Institute
   www.ansi.org

4. ASTM – American Society of Testing and Materials
   www.astm.org

5. BICSI – Building Industry Consulting Service International, Inc.
   (RCDD Standards)
   www.bicsi.org

6. CFR – Code of Federal Regulations
   www.gpo.gov/fdsys/browse/collectionCfr.action?collectionCode=CFR
   (Available from the Government Printing Office)
   (Material is usually first published in the Federal Register)

7. U.S. Copyright Law, December 2011
   www.copyright.gov/title17

8. ECIA – Electronic Components Industry Association
   ESC – EIA Standards Council
   www.eciaonline.org

9. IACS – International Annealed Copper Standard
   www.ndt-ed.org/GeneralResources/IACS/IACS.htm

10. IEC – International Electrotechnical Commission
    www.iec.ch

11. IEEE – Institute of Electrical and Electronics Engineers
    standards.ieee.org

12. ISO – International Organization for Standardization
    www.iso.org

13. ITU-T – International Telecommunication Union – Telecommunication
    www.itu.int

14. NEC – National Electrical Code (NFPA 70)
    maintained by NFPA – National Fire Protection Association
    www.nfpa.org

15. NECA – National Electrical Contractors Association
    www.necanet.org

16. NEMA – National Electrical Manufactures' Association
    www.nema.org

17. OSHA – Occupational Safety and Health Administration
    (U.S. Department of Labor, OSHA)
    www.osha.gov

18. TIA – Telecommunications Industry Association
    www.tiaonline.org/standards

19. UL – Underwriters' Laboratories
    www.ul.com

B. Standards: Referenced standards and/or procedures shall be binding on the Contractor and work shall be judged against such standards and procedures unless otherwise stated in writing.

C. Local/State Codes: Contractor shall comply with all local and state code requirements as determined by the authority having jurisdiction (AHJ).

D. Owner Standards: Contractor shall obtain and abide by all published Owner standards as they pertain to the work described herein.

E. Contractor shall use the latest versions of all standards and codes unless otherwise directed by the authority having jurisdiction (AHJ) or expressly noted herein.

1.7 Qualifications

A. Refer to related sections for specific requirements.

1.8 Permits and Inspections

A. Responsibility: Obtain permits and inspections required for the work. Contractor is responsible for all permit and inspection costs.

B. Performance: Perform tests required herein, or as may be reasonably required to demonstrate conformance with the specifications or with the requirements of any legal authority having jurisdiction.

C. Review: Obtain approvals from authorities responsible for enforcement of applicable codes and regulations to establish that the work is in compliance with all requirements of reference codes indicated herein and required by the appropriate jurisdiction. Make corrections, changes or additions as required and deliver certificates of acceptance, operation, and/or compliance with the Operation and Maintenance Manuals described herein.

1.9 Drawings and Basis of Design

A. General: Work, equipment, or material delineated on any drawing in this package is expected to be provided by Contractor unless noted otherwise.

B. Interpretation: Work shall be installed in accordance with the basis of design diagrammatically expressed on the drawings and described in the written specifications and equipment schedule(s). Contractor shall not make limiting interpretation that provides for incomplete work or a non-functioning system.

1.10 Product Substitution Procedures

A. Requests for Substitutions: Should the Contractor request a change in the material that is to be supplied, from that which was specified in the contract, the Contractor shall provide the Owner and the Consultant with a written request for said change.

B. Substitutions for Non-specified Products: Where no product specification is provided, Contractor may use manufacturer's specification for the identified product as a guide for suggesting appropriate substitutions.

C. Requirements: The Request for Substitution shall include:

1. Reason for substitution.

2. Material data sheets for both the proposed item(s) and the item(s) to be replaced.

3. Any cost impact to the Owner.

D. Changes: Proposed changes to Contract Documents shall be clearly identified in the pre-construction submittals.

E. Approval: The Owner may approve or deny any Requests for Substitution. The Owner reserves the right to govern over and proclaim whether proposed products are equal to the specifications. The Contractor shall not procure any substitute materials until the Owner has approved and signed the Request for Substitution and passed copies to the Contractor and the Consultant. Any procurement or work performed prior to this approval is at the Contractor's own risk.

F. Deviation: Products provided or installed that deviate from the products specified in make, model, color, or other significant characteristic (i.e., non-approved substitutions) shall be removed and replaced with specified products at no additional expense to Owner.

1.11 Software

A. Versions: Consultant used the following software versions for this project:

1. Autodesk Revit MEP 2018 (floor plans)

2. Autodesk AutoCAD MEP 2018 (detail sheets)

1.12 Submittal Conditions

A. The Contractor shall not consider the Consultant or Owner's review of submittals to be exhaustive or complete in every detail. Approval of shop drawings or submittals including substitutions indicates only the acceptance of the Contractor's apparent intent to comply with general design or method of construction and quality as specified. The finished product shall meet functional requirements, operations, arrangements, and quantities and comply with the contract documents unless specifically approved otherwise.

B. The Contractor shall be held responsible for delivery of systems as specified. Any errors or omissions in the submittals shall not relieve Contractor of responsibility to deliver complete systems as specified.

1.13 Pre-Construction Procedures

A. Pre-Construction Submittal Meeting: Contractor shall schedule web conference (WebEx or similar) with Consultant to review basis of design and submittal expectations.

B. Prior to Work: Pre-construction submittals shall be provided to Consultant with appropriate promptness as to cause no delay to the work.

C. Project Timeline: Project timeline will not be altered due to lateness of submittals. Contractor is bound to deliver a timely, complete, and finished project as stipulated in their contract and specified herein.

D. Format and Distribution: Contractor shall provide one (1) electronic copy in PDF format to Consultant of all pre-construction submittals. The Contractor shall provide hard copies sets as required up to five (5) sets.

E. Provision: Contractor shall submit pre-construction submittals including any corrections or additions to Consultant prior to the procurement of equipment or commencement of work.

F. Review: Pre-construction submittals shall be received and formally approved by Consultant prior to the procurement of material or the commencement of work. Any procurement or work performed prior to this approval is at Contractor's own risk.

G. Failure to Provide: The failure of Contractor to provide pre-construction submittals as required herein may result in the withholding of payment for work and/or the cancellation of the contract.

1.14 Pre-Construction Submittals

A. Pre-construction submittals are intended to document the details of installation. Exact copies of original drawings and specifications are not acceptable as pre-construction submittal drawings. Consultant schematic diagrams describe the basis of design as defined herein.

B. Contractor shall provide to Consultant the following pre-construction submittals for approval in addition to specific requirements identified in subsequent sections.

1. Qualifications: Shall include documentation of all required qualifications.

2. Shop Drawings:

a. Title: Each drawing shall have a descriptive title and all subparts of each drawing shall have unique identifiers.

b. Floor Plans: Shall include device locations, Contractor provided furniture and installation notes.

c. System Drawings: Shall include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, wiring signal type, cable identification detail, connectors, adapters, intra/inter-rack power distribution, installation notes and any other information required to convey the complete turnkey system design.

d. Equipment Rack and Cabinet Elevations: Shall include placement of all mounted equipment.

e. Structurally Mounted Elements: Shall include both plan view of placement as well as a detail of structural mounting techniques to be used.

f. Furniture: Shall include all Contractor provided furniture showing dimensional drawings, cable management and finishes with samples for Owner approval.

3. Product Data:

a. Equipment Schedules: Shall include manufacturers, part numbers, quantities and unit pricing.

b. Product Cut Sheets: Shall identify (highlight, arrow, etc.) actual part numbers to be utilized including but not limited to equipment, mounting hardware, cabling, connectors, software and power distribution equipment.

4. Manufacturer's Recommendations:

a. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, copies of these recommendations shall be provided prior to installation. Installation of the items will not be allowed to proceed until the recommendations are received and approved.

1.15 Pre-installation Procedures

A. Refer to individual sections for additional information.

1.16 Construction Progress Procedures

A. Meeting Attendance: Contractor is required to attend job progress meetings in accordance with requirements set by Owner or Consultant.

B. Additional Coordination: Contractor shall request additional job construction coordination meetings it deems to be necessary to ensure coordination of their responsibilities with other parties.

C. Progress Inspection: Consultant may perform periodic progress inspections. At Consultant's request, Contractor shall make Project Manager and/or Lead Technician available.

D. Test Plan: Ten (10) business days prior to the proposed Contractor test date, Contractor shall provide a test plan defining the tests required.

1. The test plan shall be approved by Consultant prior to any testing.

1.17 Construction Progress Submittals

A. Completion: Contractor shall complete and submit via email all construction progress documentation in PDF format as requested by Owner and Consultant.

B. Contractor shall provide to Consultant the following construction progress submittals in addition to specific requirements identified in subsequent sections.

1. Weekly Report: Weekly written report to be submitted to Consultant through appropriate project channels in PDF format outlining progress from previous week, plans for progress in the current week, and any coordination issues that may require Consultant or Owner attention.

2. Test Plan: Shall ensure the system meets Owner operational and performance specifications and include the following:

a. Identification of the capabilities and functions to be tested.

b. Detailed instructions for the setup and execution of each test.

c. Procedures for evaluation and documentation of the results.

C. Failure to Complete: Failure to complete requested construction progress documentation may result in the withholding of payment by Owner.

1.18 Closeout Procedures

A. Notification: Contractor shall provide written notification to Consultant and Owner when Contractor is satisfied that the work has reached Substantial Completion and is ready for inspection.

B. Pre-Inspection Submittals: Contractor shall submit an electronic copy of all closeout submittals to Consultant in accordance with the requirements found in these documents no less than ten (10) business days prior to the scheduled Final Inspection.

1. Test Results

2. As-built drawings (full-size sheets)

3. Operation and Maintenance Manuals

4. End User Software

5. Photos that demonstrate complete system installation.

C. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in these documents, and/or unacceptable to Consultant or Owner shall be documented by Consultant and provided to Contractor to rectify at no additional cost. Contractor shall provide written notification to Consultant and Owner when all punch list items have been completed.

D. Final Inspection: At Consultant's request, Contractor shall make Project Manager and/or Lead Technician available.

E. Re-Inspection: If more than one (1) re-inspection is necessary, the costs of the additional travel, time, and expenses of Owner and Consultant may be deducted by Owner from the contract amount due to the Contractor.

F. Punch List Approval: Once all punch list items are complete, the Contractor shall return an initialed punch list to the Consultant and Owner for verification. Punch list shall be considered complete only after having been signed by Owner and Consultant.

G. Closeout Submittals: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide three (3) electronic copies to Owner and Consultant in format(s) noted below.

1. Record Drawings – AutoCAD 2010 editable .dwg format AND PDF.
2. Operation and Maintenance Manuals – CD OR DVD.
3. End User Software – CD OR DVD.
4. Documentation of testing and system certification.

H. Closeout Submittal Format and Distribution: Upon approval of closeout submittals and prior to final acceptance, Contractor shall provide a total of three (3) bound hard copies and one (1) digital copy with labeled dividers of all record drawings (full-size sheets) and operation and maintenance manuals, three (3) copies to Owner and one (1) digital copy to Consultant. Title on front and spine of binder shall be "Operation and Maintenance Manual – [Project Name]". The following additional items shall be identified on the binder cover:

1. Client Name
2. Contractor Name and Contact Information
3. Consultant Name and Contact Information
4. Date

I. All documentation prepared by the Contractor, including hard copy and electronic forms, shall become the property of the Owner.

J. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by Owner and Consultant, including punch list(s) and/or re-inspection(s) and delivery of closeout deliverables.

1.19 Closeout Submittals

A. Closeout submittals are intended to document the details of the final installation that substantially conforms to the construction documents and functions as intended to meet the Owner's needs.

B. Contractor shall provide to Consultant the following closeout submittals for approval in addition to specific requirements identified in subsequent sections.

1. As-built drawings: As-built drawings are prepared by the Contractor. They show, in red ink, on-site changes to the Consultant-approved pre-construction submittal documents. As-built drawings shall be submitted to Consultant for approval prior to submitting record drawings and include:
    a. Changes made by Addenda, Change Orders, Requests for Information (RFIs), Architect's Supplemental Instruction (ASIs), or Requests for Proposal (RFPs) in addition to any other changes to the original documents.
    b. Actual device locations, conduit routing, wiring and relationships as they were constructed.
    c. Nomenclature showing as-built wire designations and colors.
    d. Room numbers coinciding with Owner space planning numbering.
2. Record drawings: Record drawings are the final drawings prepared by the Contractor and incorporate all as-built drawing changes previously approved by Consultant. Record drawings should be electronically produced without any handwritten, red ink, or clouded changes.
3. Operation and Maintenance Manuals: Notwithstanding requirements specified elsewhere, submit one (1) copy of each of the following per binder:
    a. A final Bill of Materials for each system.

b. A Microsoft Excel (.xlsx format) spreadsheet for each device that resides on the network provide the following:

i. IP Address

ii. MAC Address

iii. Serial Number

iv. Manufacturer

v. Model Number

vi. Device Username

vii. Device Password

viii. Telecom Closet or Rack Location

ix. Patch Panel Port Number

x. Switch Port Number

xi. Any other relevant information as requested by Owner

c. Manufacturers Instruction Manuals: Specification sheets, operation manuals and service sheets published by the manufacturers of the components, devices and equipment provided.

d. Information for testing, repair, troubleshooting, assembly, disassembly, and recommended maintenance intervals.

e. Replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.

f. Performance, Test, and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.

g. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturers' Warranty Registration papers as described herein.

h. Sufficient information, (detailed schematics of subsystems, assemblies, and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.

i. Any other items defined herein.

4. Local Reference Diagrams: Within each equipment rack, enclosure, or cabinet, the Contractor shall place a functional diagram of the system(s) in a clear plastic sleeve secured to the equipment rack, cabinet, or enclosure.

5. Intellectual Property: Provide all required items and written release as described herein.

6. Training Program: Proposed training materials and program outline.

7. Spare Parts and Remote Controls: Contractor shall submit record of Owner sign-off of turnover of spare parts and remote controls.

1.20 Project Management

A. Project Manager: Contractor shall appoint a Project Manager who will be the main point of contact for Owner and Consultant regarding the project.

B. Responsibility: Project Manager is responsible for the following:

1. Successfully completing the contract in a timely manner.

2. Overseeing work and performance of all employees and Subcontractors who have been hired by Contractor, and ensuring compliance with specification.

3. Completing and submitting required documentation.

4. Attending project coordination meetings as required by Owner, Consultant, and Contractor. Contractor is responsible for taking minutes of these meetings and distributing copies to all participants in a timely manner.

5. Coordinating with Owner, Consultant, Architect, General Contractor, and other Contractors involved in the project to ensure smooth flow of work and on-time project completion.

6. Providing a written weekly progress update to the Owner and Consultant in a PDF format emailed to the project team.

7. Reporting all unexpected conditions and problems that may result in delay or expense to Owner and Consultant immediately upon discovery.

C. Change of Project Manager: If Contractor seeks to change Project Manager during the course of the Project, such change is subject to prior written approval from Owner.

D. The Owner reserves the right to request a change of project manager at any time for any reason.

1.21 Examination of Existing Conditions

A. Examination: Contractor shall examine the facility and construction documents to the extent necessary to plan for efficient installation strategies prior to the delivery of materials to the site or the commencement of work. Other documents (Architectural Drawings, hardware schedules…) may be made available upon request. Failure to adequately complete the examination shall not result in change order requests.

B. Acceptance of Conditions: Commencement of work by Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to Owner prior to commencement.

C. Observation: If Contractor observes—during preliminary examinations or subsequent work—existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, Contractor shall report these to Owner in a timely manner.

D. Pre-Existing Damage: If Contractor observes damage to finished surfaces before they begin installation in any area, Contractor shall document by taking digital photos of the damaged area(s) and immediately notify Construction Manager and Consultant via email with attached photos.

E. Damage during Installation: Any damage caused by, or reasonably believed by the Construction Manager to be caused by the Contractor shall result in back-charges for said damages. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor damaged ceiling tiles, floor, and carpet shall be replaced to match color, size, style, and texture.

1.22 Contract Modification Procedures

A. Changes: Changes to the contract may be initiated by Owner, Consultant or Contractor.

B. Request for Information (RFI): If a change originates with Contractor, the Contractor shall submit an RFI for Consultant review. If it is deemed a change is necessary, the Consultant shall issue a PR to address the change.

C. Proposal Request (PR): If a change originates with Owner or Consultant, Consultant shall issue a Proposal Request to Contractor.

D. Change Proposal (CP): If a change originates with Contractor, or if Contractor receives a Proposal Request from Consultant, Contractor shall submit a Change Proposal to Consultant to review.

1. References: A Change Proposal shall reference the work to be performed, and shall include the cost change to the Project (if any) and the time change to the scheduled completion (if any).

2. Additional Information: Consultant may request additional information to be supplied with the Change Proposal for consideration.

3. Acceptance: Owner reserves the right to accept or reject Change Proposals.

E. Change Order: A Change Order is a modification of the contract.

1. If a Change Proposal is approved, Owner will issue a Change Order that references PR and/or CP. Change Order is not valid until it has been signed by Owner.

2. Work performed or equipment supplied outside of contract without a valid Change Order is done at Contractor's own risk.

1.23 Product Storage and Handling Requirements

A. Storage: Contractor shall provide secure material storage. If Contractor chooses to store cabling or equipment at project site, that Contractor shall receive written approval from GC or Owner to identify acceptable location. All equipment provided by the Contractor remains the responsibility of that Contractor until Owner has beneficial use of the equipment.

B. Protection: Contractor shall take all necessary precautions to protect materials from the following:

1. Theft

2. Vandalism/Tampering

3. Dents

4. Scratches

5. Dust

6. Temperature

7. Weather

8. Cutting

9. Paint

10. Other hazardous conditions

C. Replacement: Contractor shall replace any damaged or lost material as required by Owner or Consultant.

D. Installed Materials: Installed materials remain the responsibility of the Contractor until Acceptance. Contractor shall take necessary precautions to ensure the safety and security of installed materials.

1.24 Interference with the Facility

A. Transportation and storage of materials at the facility, work involving the facility, and other matters affecting the habitual use by the Owner of the Owner's buildings, shall be conducted to minimize interference, and at times and in a manner acceptable to the Owner.

1.25 On-Site Conduct

A. Conduct: Any demonstration of rudeness, use of profanity, or lack of respect by Contractor Personnel to a building tenant will be cause for immediate removal from the premises, and such Personnel will not be allowed to return. Contractor and Contractor's Personnel are to remain in project area.

B. Vandalism: Graffiti or vandalism will not be tolerated. Any Contractor/Personnel caught in the act shall be immediately removed from the premises and will not be allowed to return.

C. Hazardous Conditions: No one shall be allowed to endanger the building, its premises, or its occupants in any manner whatsoever. In the event that a situation occurs which threatens the building or its occupants in any manner, Contractor, Contractor Personnel, Subcontractor, etc. shall take immediate steps to correct the hazardous condition. In the event that Contractor's Personnel fail to correct hazardous condition, Owner reserves the right to immediately take steps to correct the situation at Contractor's expense.

1.26 Safeguards and Protection

A. Barriers: Provide and maintain suitable barriers, guards, fences and signs where necessary to accommodate the safety of others relative to and/or for the protection of this work.

B. Regulations: Comply with OSHA, Federal, State, Local, and Owner regulations and standards pursuant to this work.

C. Protection: Protect all materials and equipment to prevent the entry or adhesion of any and all foreign material. If necessary, cover equipment with temporary protective material suitable for this purpose.

D. Finishing: Check, clean and remove defects, scratches, fingerprints and smudges if necessary from all equipment and devices immediately prior to Acceptance of the Installation.

E. Damage: Replace all damaged or defective material or work at no additional cost prior to Final Acceptance.

F. Documentation: Provide written description of accidents by workers, staff, and general public of any incident occurring on the project. Report incident in writing to Owner's representative immediately and to the Project Manager for follow up.

1.27 Owner-Furnished Products

A. Delivery: Owner is responsible for delivery of Owner-furnished products to the project site, unless otherwise specified in this document.

B. Placement: Contractor is responsible for locating, inspecting, and moving Owner-furnished products to their final installation position.

C. Inspection: Contractor shall report any damage, discrepancies in quantity, type, or function to Owner and Consultant immediately upon discovery.

D. Warranty: Contractor assumes no responsibility for any material warranty for Owner-furnished products. Contractor shall be responsible for integrating, cabling, and installing Owner-furnished products under the same warranty conditions as other products furnished by Contractor.

1.28 Quality Assurance

A. Assurance: It is the intent of these specifications to describe and provide for a complete, professional, and reliable installation.

B. Qualifications: Contractor employees who are engaged in installation shall be properly trained in the tasks they are expected to perform.

C. Acceptability: Owner shall determine the acceptability of work.

D. Regulatory Requirements: Contractor shall comply with code requirements that apply to the work being performed.

E. Certifications: Where manufacturer certifications are required for warranty or for authorized resale, installation personnel shall have received such certification prior to the start of installation of those manufacturers' materials.

1.29 Quality Control

A. Installation: During installation period, when connections are made to the Owner's existing infrastructure, Contractor shall use care to ensure that such connections will not have a negative impact which could reduce or hamper existing systems.

1.30 Owner's Right to Use Equipment

A. The Owner reserves the right to use equipment, material and services provided as part of this work prior to Acceptance of the Work, without incurring additional charges and without commencement of the Warranty period.

1.31 Intellectual Property Ownership

A. All intellectual property shall remain in escrow for an unlimited period of time. All supporting documentation including but not limited to: software, firmware, programming, uncompiled source code, graphic files, diagrams, written and electronic files, including all latest versions of the documentation and software necessary to edit and adapt the system(s), shall be provided to the Owner on a CD or DVD for all spaces and all systems. The integrator and/or programmer shall also maintain a current live copy incorporating all system modifications to be provided at the Owner's request and for system restoration upon a failure.

B. A written release shall be given by the Contractor and all other required parties for all programming and configuration done by the Contractor and/or Subcontractors. This release will acknowledge the Owner's ownership and right to modify the intellectual property directly, or to have the intellectual property modified by any party of the Owner's choosing.

PART 2 - PRODUCTS

2.1 Basic Equipment and Materials Requirements

A. Standards: Equipment and materials used to accomplish the goals of this project shall meet standards for good engineering practice as defined within this document.

B. Quality: Products specified in these documents are intended to establish a baseline or operational, functional, and performance-based standards that all proposed products shall meet or exceed by functionality and quality.

2.2 Factory-Assembled Products

A. Manufacturer: Reference to specific equipment manufacturers does not imply that all products produced by that manufacturer meet the specification requirements.

B. Age of Equipment: Equipment shall be new and unused with full manufacturer's warranties. Contractor shall supplement such warranties as required by the specification. Contractor shall immediately notify Consultant of any product that will be or is expected to be discontinued by the end of the project for resolution.

C. No Modification: Where a product is available from a factory/manufacturer to meet the needs as outlined, that product shall be used without modification to ensure the full factory warranty is maintained.

D. Like Materials: Like materials used shall be of the same manufacturer, model, and quality unless otherwise specified.

E. Software/Firmware: No software or firmware is to be used unless specifically authorized by Owner or its appointed representative.

2.3 Racks, Cabinets, Hardware

A. Equipment Racks and Cabinets: Provide racks and cabinets as specified herein and/or described in accompanying documents, appendices, or drawings. Verify that any existing racks and/or cabinets provided by others are complete, bringing any discrepancies to the attention of Owner and Consultant prior to beginning the installation.

B. Shelves and Mounts: Contractor shall supply necessary mounting hardware to install rack-mounted equipment. Mounting hardware shall be a product of the manufacturer of the equipment to be mounted, or manufacturer of the rack system, or approved by either for use with their product. Provide supporting channels, shelves, rack mounts, and/or rack ears as recommended by equipment manufacturers.

C. Screws and Washers: Contractor shall provide screw head types appropriate to the level of security required for the equipment and racking. Screws shall include polyethylene or nylon washer.

1. Public Access Areas: Star post or square post security screws shall be used for hardware and equipment mounted in equipment racks and consoles in areas that are accessible to the public.

2. Restricted Access Areas: Philips head screws may be used where a secure room entrance or locked rack/console door prevents public access.

2.4 Power Devices

A. Power Strips: Unless otherwise specified, power strips shall be UL listed, surface mounted, and rated for 20 amp continuous electronic loads. Outlets shall be 125 volt, 20 amp, three-wire, grounded, and NEMA 5-20R compliant. Cords shall be 12/3 SJT with molded plug.

B. Power Distribution Panels: Unless otherwise specified, power distribution panels shall be UL listed, rack mounted, rated for 20 amp continuous electronic loads, with switch and pilot light. Up to eight outlets shall be mounted to the back, each rated 125 volt, 20 amp, three-wire, grounded, and NEMA 5-20R compliant. Switch and pilot shall be mounted to the front. Cords shall be 12/3 SJT with molded plug.

C. Contractor shall provide acceptable power distribution units as required in order to provide sufficient outlet connectivity for Contractor-furnished and Owner-furnished equipment indicated on drawings and equipment schedules, plus up to 15% additional capacity for future growth. This may be in addition to any power distribution equipment indicated on equipment schedules.

2.5 Cable and Connectors

A. Cable: Cable shall be selected and applied in a manner defined by signal type, consistent with best industry practices. Highest quality products shall be used with attention given to transmission characteristics, termination methods, resistive and complex impedance at operating frequencies, and insulating material characteristics. Where required by the NEC, substitutions of air handing plenum cable shall exactly match the normally applied product and shall meet the standards of UL Standard #900 and the NEC Articles 800 and 820.

B. Connectors: Highest quality products shall be used with attention given to transmission characteristics, termination methods, resistive and complex impedance at operating frequencies, and insulating material characteristics. Strain reliefs and cable clamps shall be sized for the connector and the cable.

C. Color: Cable and connector color shall be coordinated with Consultant to maintain consistency with cable and connector color schemes used by other trades.

2.6 Cable Management

A. Plastic Cable Ties: Single use white nylon plastic cable ties, appropriate screw fittings, or mounting clips may be used for AC power cable management within racks and enclosures. Plastic/nylon cable ties shall not be used for signal and DC cables.

B. Velcro Cable Ties: Velcro straps shall be used for all signal and DC cables. Velcro straps shall be black, with no logo or decoration, except as authorized by Consultant.

2.7 Ancillary Hardware

A. General: Contractor shall provide ancillary and required accessory items necessary to provide a complete and fully functional system to Owner.

B. Interpretation: Exclusion of or limitation in the language used in the drawings or specifications shall not be interpreted as meaning that ancillary or accessory items of work or equipment necessary to complete or make the installed system fully functional can be omitted.

2.8 Grounding Hardware

A. Refer to Section 27 05 26 for specific Grounding and Bonding requirements.

B. Provide data/telecommunication grounding systems indicated in the project drawings and specifications. Products shall include, but are not limited to, cables/wires, connectors, terminals, compression lugs, grounding rods/electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, ANSI/TIA and established industry standards for applications indicated.

2.9 Fire Stopping Materials

A. All penetrations of walls shall be approved by the General Contractor before any penetrations are made. Should the Contractor find it necessary to penetrate any walls extending to the slab, it will be the responsibility of that Contractor to provide satisfactory sleeving and fire caulking both inside and outside of that sleeving. If existing sleeving is to be utilized, it will be the responsibility of the Contractor to fire caulk inside the sleeving.

B. The Contractor is responsible for adhering to the following standards:

1. Conduit penetrations through fire-rated or smoke walls: Completely seal around the conduit penetration with Hilti FS 601 fire-rated sealant or equivalent by Tremco, 3M, or equal.

2. Conduit sleeves through fire-rated or smoke wall: Completely seal around the conduit penetration with Hilti FS 601fire-rated sealant or equivalent by Tremco, 3M, or equal. Completely seal inner opening of the conduit sleeve with fire wool packing and Hilti FS 611A intumescent firestop sealant.

3. Cable bundles through fire-rated or smoke walls (without sleeves): Completely seal openings with Hilti FS 611A intumescent firestop sealant or equivalent by Tremco, 3M, or equal.

4. Cable tray penetrations through fire-rated or smoke walls: Completely seal openings with Hilti FS 635 (trowelable type), or equivalent by Tremco, 3M, or equal.

C. A submitted response to this specification assumes that all firestopping will be provided as specified. The firestop manufacturer's specifications and instructions shall be submitted with the final documentation.

2.10 Compatibility of Related Equipment

A. Existing Equipment: Equipment and systems specified in these documents shall be assumed to be compatible with the systems already installed at Owner site(s) and as identified in this document as related to this project.

B. Installed Equipment: Specified equipment and systems shall be compatible with all other equipment and systems as offered by Contractor, thus placing the responsibility on Contractor to ensure proper interaction.

2.11 Licenses

A. Any and all licenses required for system functionality shall be provided.

2.12 Spare Parts

A. Suggested List: Contractor is requested to submit a list of suggested spare parts with an offered price, allowing Owner to select appropriate parts.

B. Means of Obtainment: Contractor shall state where spare parts can be obtained after the installation.

2.13 Maintenance Manuals

A. Contractor shall produce a maintenance manual showing interconnection of equipment and any special procedures necessary for proper operation and maintenance of the systems.

PART 3 - EXECUTION

3.1 General

A. Contractor shall provide, furnish, deliver, transport, erect, install, connect and configure all of the material and equipment described herein or depicted on any bid package document or drawing, as required for a turnkey solution.

3.2 Coordination

A. General: Contractor shall cooperate with other Contractors for proper provisioning, anchorage, placement, and execution of all work. Interference between the work of various Contractors shall be resolved before installation. In the event of conflict on space requirements or location of devices, refer the matter to Owner and Consultant for decision.

B. Related Work: References to the following related work do not limit or release Contractor from the responsibility of coordination with other trades or from having the necessary knowledge of other non-referenced work.

1. Work by General Contractor.

2. Work by other Technology Contractors.

3. Work by Electrical Contractor, including electrical rough-ins and surface-mounted raceway.

C. Delays: Contractor shall coordinate with all other trades to avoid causing delays in the installation schedule.

D. AC Power: Contractor shall coordinate with General Contractor its requirements for proper AC power to service all equipment installed by Contractor.

E. Low Voltage Sleeving: Contractor shall provide openings through walls as necessary, with sleeving and fire-stopping materials installed in a professional manner to meet local and national codes.

F. Grounding and Bonding: Contractor shall coordinate with General Contractor its requirements for proper grounding and bonding to their equipment.

G. Surface-Mounted Raceway Coordination

1. General and Electrical Contractors: Contractor shall coordinate with General Contractor and Electrical Contractor the installation of surface-mounted-raceway where not provided but made necessary by non-penetrable wall.

2. Verification: Contractor shall field verify and coordinate the proposed use of surface-mounted raceway at any location with Consultant and Owner.

3.3 Basic Execution Requirements

A. General: Contractor is responsible for following industry standards of good practice for telecommunications and networking equipment.

B. Aesthetic Factors: With the installation of equipment and cables, consideration shall be given not only to operational efficiency but also to overall aesthetic factors. Contractor shall redo, at no cost to Owner, any work deemed by Owner to appear sloppy, hastily done, or unprofessional. Owner shall make final decision over whether work shall be redone.

C. Manufacturers' Recommendations: Manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers or as indicated in their published literature unless otherwise noted herein.

D. Protection of Work Area: Work shall be properly protected during construction; including shielding soft or fragile materials, protecting against dust and dirt, protecting and supporting cable ends off of the floor and from other traffic, protecting floor box lids, and temporarily plugging open conduits during construction. Upon completion, installation shall be thoroughly cleaned and all tools, equipment, obstructions, or debris present as a result of work shall be removed from the premises.

E. Protection of Cable and Equipment: Contractor shall make appropriate preparations to protect all cabling and equipment from foreign material. Foreign material is defined as any substance or material that would void the manufacturer's performance warranty, impact ratings (UL, Plenum, etc.), or cover up markings needed for inspection. Foreign material includes, but is not limited to, paint overspray (intentional or not), fire-stopping material, drywall compound, or any other chemical, liquid, or compound that could come in contact with cables, cable jackets, cable termination points, or other equipment.

1. Cleaning of cables or equipment with harsh chemicals from a failure to comply with Protection of Cable and Equipment clause is unacceptable. Contractor shall replace any affected cable, cable components, or equipment in their entirety at Contractor's sole cost.

F. Waste Materials: Contractor shall keep work area neat, orderly, and free from accumulation of waste materials. Remove trash and debris from the building and job site as required to maintain a clean work environment at all times. Rubbish shall be moved to a common trash point or receptacle on the job site as determined and directed by General Contractor or Owner.

G. Dumpsters: No construction debris shall be placed in building's dumpsters. Contractor shall provide a dumpster for construction waste and debris at own expense. Said dumpster shall be emptied on a regular schedule. Location of dumpster shall be arranged through Building Management. Appropriate measures shall be taken to protect asphalt or other ground surfaces.

H. Ceiling Grid: Contractor shall not hang cable supports from ceiling grid wire.

I. Roof Deck: Contractor shall not shoot into the roof deck for mounting cable hangers.

J. Mounting: Equipment and enclosures shall be mounted plumb and square in relation to the structure.

K. Raised Floor: All cabling installed below the raised floor shall be placed in the provided cable trays with appropriate means to hold cable in place. If no cable tray exists, Contractor shall provide J-hooks to hold cables in place. Sleeves shall be utilized for cable egress.

L. Motorized Furniture: Care shall be taken to properly dress all cables placed within motorized furniture and provide sufficient cable length and strain relief to allow motorized elements to operate within their full range of travel.

M. Flexible Furniture: Care shall be taken to properly dress all cables placed within flexible or re-configurable furniture to provide sufficient cable length and strain relief to allow full range of travel for flexible furniture configurations.

3.4 Preparation

A. Existing Equipment: Prior to any installation, the Contractor shall prepare the site by removing any remaining debris, leveling equipment racks (where appropriate), and verifying information and systems stated to be in-place are ready for use.

B. Equipment for Installation: Prior to installation, Contractor shall ensure that required major equipment has been secured and is ready for installation.

3.5 Cleaning

A. Tool Clean-up: Contractor is not permitted to use restrooms for tool clean-up. A slop-sink may be provided in janitorial closet on each floor for cleaning of tools and equipment and as a source of water. Janitorial closet or maintenance area or shop shall be kept clean at all times. Contractor or Contractor's Personnel found using restrooms for clean-up or other similar purposes shall be subject to removal from building.

B. Daily: At the end of each work period or day, Contractor shall remove excess packing, drilling remnants, and other non-equipment related parts, materials, or debris to ensure a clean, safe, and professional working environment.

C. Carpet: Contractor shall ensure that no damage to carpeting occurs as a result of their work. Contractor shall cover carpets in areas of work to prevent wire and other debris from entering the carpet.

3.6 Demolition

A. General: The Contractor shall be responsible for removal, collection, transportation, and recycling of all cabling and components that become abandoned as a result of this project. This shall include the delivery of cable and components to the proper recycling centers. If material is to remain on site for more than seven days after removal, Contractor shall coordinate with Owner for an acceptable storage location.

B. Verification: Contractor shall field-verify existing conditions prior to beginning demolition work. Any discrepancies shall be reported to the Consultant prior to the start of work in order to prevent disturbance of existing installation(s). Beginning work shall indicate acceptance of existing conditions. Contractor is responsible for immediately restoring any outages caused as a result of removing or damaging adjacent cabling, systems, or services.

C. Abandoned Cable: The Contractor shall remove all abandoned cable back to the headend. Where it is not possible to remove cables without damaging other cables that are to remain, such as in a shared conduit, the Contractor shall report these conditions to the Consultant for approval. These cables shall be cut at entry and exit points, leaving a minimum of 24" of cable at each end.

D. Cover Plates: The Contractor shall provide and install blank cover plates for any outlets or junction boxes that are to be left in place and from which all cables have been removed. Cover plates shall match the Project standard color and finish.

E. Equipment: The Contractor shall remove all equipment abandoned as part of this project. The Contractor shall be responsible for the delivery of this equipment to a proper recycling facility. Any electrical service connected to the equipment shall be properly decommissioned and labeled to prevent any safety issues.

F. Right of Refusal: The Owner shall have first right of refusal to any abandoned cable or equipment. The Owner has the right to remove any components from the equipment before it is recycled.

3.7 Fire Stopping

A. Contractor is responsible for applying fire-stopping material in and around all openings that it creates or are created for it, whether or not specifically indicated in specifications or project drawings, where code requires the use of fire stopping material.

B. Contractor shall ensure that all fire-stopping materials meet appropriate codes and are installed in a neat and workman like manner.

3.8 Waterproofing

A. Contractor is responsible for creating a waterproof seal in and around any openings to the outside environment that are created by Contractor or for systems being installed.

B. Contractor shall ensure that all waterproof materials meet appropriate codes and are applied according to good engineering practice.

3.9 Racks, Cabinets, and Hardware

A. Racks and Cabinets: Contractor shall assemble and install racks and cabinets.

B. Installation Hardware: Install hardware in a secure manner. Screws shall be tightened to a torque just sufficient to secure equipment without deforming washers beyond their original diameter.

C. Considerations: Rack mount equipment shall be secured as recommended by the manufacturer with consideration to airflow, power, and in/out connections.

D. Cross Connections: Where cross connections are required between equipment, interconnections shall be installed using cable management devices to secure cables in a neat and workmanlike manner, applying best industry practices.

3.10 Installation Requirements

A. Cable pulling shall be done in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 standards. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

B. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a "break-away", or other approved method.

C. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of pathway entry and exit.

D. All cable shall be free of tension at both ends.

E. PLENUM rated cable shall be used in areas used for air handling or where required by code.

F. Contractor shall replace any cables that have been damaged or abraded during installation.

G. Pulling lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used and will not harden or become adhesive with age.

H. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit or surface mount raceway.

3.11 Cable

A. Cable treatment: Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the rating of the manufacturer.

B. Splicing

1. Voice, data, and other twisted pair cables: No splices shall be installed in any voice, data or twisted pair cables.

2. Technology systems: No splices shall be installed in any cable less than five hundred (500) feet in length.

3. Digital multimedia/video cables: No splices are allowed in any digital multimedia/video cable.

4. Overhead paging systems: Cable splices for constant voltage overhead paging system shall occur only at speaker, amplifier or volume control knob locations.

C. Lengths

1. Variations: Where cables are to be of the same length, variations in the length shall be less than plus or minus ½ inch. Lengths of cables are based on the length of the unterminated signal conductors.

2. Labeling: Cables, regardless of length, shall be marked with a labeling scheme approved by Consultant.

3. Service Loops: A surplus of cable, located at or near the point of termination to facilitate potential future changes, shall be provided where appropriate. Cables shall have a minimum cable slack of 10ft (3m) at the telecommunication room(s) and 3.28ft (1m) at each telecommunications outlet in the suspended ceiling unless noted otherwise. Service loops shall be stored in an extended loop or in a figure-eight configuration, not in bundled loops.

D. Grouping

1. Cables shall be separated into like groups according to signal or power levels.

2. Power Cable Group: Power cables shall be secured to one side of the rack separate from any low-energy signal cable groups. Separation shall be a minimum of 4" in all directions.

3. Signal Cable Group: Signal cables shall be grouped according to signal type and secured to one side of the rack separate from any power cable groups. Separation shall be a minimum of 4" in all directions.

E. In Equipment Racks

1. Equipment rack wiring and cabling shall be neatly dressed.

2. Fastening: Rack cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame.

F. Support for Cables Outside of Equipment Racks

1. External wire and cables shall be supported at least every 5 feet (1.5m) from the structure and as required to maintain less than 12 inches of cable sag between supports without over-tensioning the cables. Contractor shall vary the precise distance between cable supports on long runs to avoid harmonics issues.

2. Hardware: Cables shall be supported by J-hooks, cable tray, or ladder rack. Hardware shall be secured to building structure using 3/8" threaded rod supports.

    a. Right Angles: Cables are to run at right angles to the structure, placed above ceiling in halls or corridors.

    b. Height: Cables shall not run above red iron joist.

G. Concealment: Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests. Cabling systems installed in public areas shall be installed within walls, ceiling, or floors or within surface wiring pathways, as dictated by codes and good engineering practice.

H. Velcro Straps for Horizontal Cabling: Straps shall be installed snugly without deforming cable insulation. Straps shall be spaced at uneven intervals not to exceed 4 feet.

I. Cable Ties and Velcro Straps within Equipment Racks and Cabinets: Ties and straps shall be installed snugly, without deforming cable insulation, at uneven intervals not to exceed 8 inches. Cable ties shall only be used for non-signal carrying cables. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Obstruction: Contractor shall notify Owner immediately if any obstruction or hazard is discovered in a pathway provided by others.

3.12 Connectors

A. Preparation: Cables shall be carefully prepared and connectors installed as directed by the manufacturer. Proper stripping devices and crimping tools shall be used.

B. Terminations: Connectors shall be carefully fitted to mating devices on equipment to avoid damage to mating contacts, inserts, or bodies. Specialized terminations shall be made in a neat and secure manner suited to the service of the wire and as directed by the manufacturer. Contractor shall use manufacturer specified terminations when those specifications exist.

C. Soldering: A person skilled in that practice shall execute soldered terminations. Any excessive insulation displacement resulting from soldering shall be grounds to require the Contractor to re-terminate the connector.

D. Adapters: Adapters shall be used only where the identity of the necessary type of connector is unknown at the time of installation, such as for Owner-provided equipment or in anticipation of future equipment upgrades, with Consultant's approval.

3.13 Spare Parts and Remote Controls

A. Keys: Contractor shall turnover all keys, tagged and organized by type on individual key rings, to Owner upon project completion.

B. Refer to individual sections for spare parts and remote control requirements.

3.14 Equipment Installation

A. General: Contractor shall make system properly operational and physically secure by mounting equipment and related accessories into furniture, consoles, and racks as required. Manufacturer's guidelines for installation shall be followed. Discrepancies in installation procedure or inability to

complete a given task due to a shortage of materials or malfunctioning equipment shall be reported to Consultant immediately upon discovery.

B. Equipment Placement: Contractor shall locate equipment as indicated on drawings and as specified herein. Where such information is not provided, Contractor shall follow industry best practices and locate operable devices at convenient positions; heat generating devices at the top and seldom-accessed equipment below.

1. Unless otherwise specified, end user-operable devices shall be positioned within the range of front wheelchair access per ADA standards.

C. Equipment Installation: Equipment shall be installed as directed by the manufacturer using equipment manufacturer's desktop mounting frames, equipment tubs, installation hardware, and techniques. Contractor shall be responsible for moving equipment from storage and for providing necessary personnel or devices to carry and lift equipment around obstacles and into operating position.

3.15 Firmware

A. Firmware shall be latest version supported by software and/or equipment as of Date of Acceptance.

3.16 Rough-In

A. Scheduling: Contractor shall make every effort to install systems per this specification in a timely manner including rough-in of cabling and other apparatus where appropriate to stay on schedule.

B. Protection of Environment: Where cabling and/or equipment is installed prior to other trades completing their work in an area, Contractor shall take necessary precautions to cover, wrap, or otherwise protect to reduce possible damage which may result from plastering, painting, cleaning, or other such work completed after installation and before substantial completion of the project.

3.17 Cutting, Drilling, Patching, and Painting

A. Coordination: Contractor is responsible for coordinating with the General Contractor and other trades when any cutting or drilling is required for the installation or proper performance of the specified systems.

B. Restoration: Contractor is responsible for returning all surfaces (including walls, floors, and ceilings) to their previous condition after any cutting.

3.18 Labeling

A. General: Rack-mounted equipment and hardware shall be labeled as required herein. Connectors, jacks, receptacles, outlets, cables, cable terminations, terminal blocks, rack mounted equipment, active slots of card frame systems, etc. shall be clearly, logically, and permanently labeled in a manner acceptable to Consultant.

B. Approval: Proposed wording and/or numbering schemes for labeling shall be provided to Consultant for review and written approval prior to procurement or installation.

C. Labels used shall be permanent and secure. Provide labeling as follows unless otherwise noted in a specific section:

1. Like Size: All labels, including engraved labels, shall be sized to match other labels used for same purpose.

2. Equipment Racks: For enclosed racks containing equipment, provide labels on each equipment rack rear door or console rear panel reading "No user serviceable parts. Refer service to qualified technician."

3. Installer and Consultant Identification: Position at the front top center section of each equipment rack a label that states the names of system Installer and Consultant.

4. Custom Panels: Custom panel nomenclature shall be engraved, etched, or screened. Markings are to be designed to ensure consistency and clarity within and without of system. Verify markings and placements by submitting label sample layouts to Consultant for approval prior to procurement.

5. Documentation: Labeling information shall appear on the as-built drawings.

3.19 Fire-Stopping

A. If Contractor removes anything from an opening in a fire-rated wall, Contractor shall restore the fire-rating condition of the wall to the same condition as before Contractor started its work. Depending on the size of the opening, this may involve sheetrock patching, in addition to use of other appropriate fire-stopping materials

3.20 Additional Engineering Services

A. General: Contractor is responsible for securing necessary engineering services where needed to meet the needs of the installation.

B. Change Orders: Only when Contractor can show that additional engineering services are needed as a result of changes to the scope of the services being requested in the contract documents will Owner entertain a Change Order Request for these services.

3.21 Testing

A. Procedure: Contractor shall develop a rigorous testing procedure to ensure full functionality and durability of installed systems under heavy-use conditions.

B. Supplies: Contractor shall supply testing equipment needed to verify compliance with specifications found in these documents.

C. Schedule: Contractor shall complete required testing prior to the substantial completion inspection by Owner and Consultant.

D. Data: Test data shall be properly documented and recorded so that it is available for final inspection.

E. Quality Control: Testing may be repeated during the inspection process at the request of Owner or Consultant.

F. Prior to energizing or testing the system, Contractor shall ensure the following:

1. Installation: Products are installed in a proper and safe manner per the manufacturer's instructions.

2. Cleanliness: Products are neat, clean, and unmarred and parts securely attached. Dust, debris, solder, splatter, etc. is removed.

3. Cables and Connections: Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. Grounding: Electronic devices are properly grounded.

5. AC Power: Each AC power receptacle is tested with a circuit checker for proper hot, neutral, and ground connections prior to connecting equipment.

3.22 Grounding

A. Refer to Section 27 05 26 for specific Grounding and Bonding installation requirements.

3.23 Training Program

A. Contractor shall provide training in the manner delineated below in addition to specific requirements identified in subsequent sections.

B. Contractor shall provide audio-video recording of each training session to Owner.

C. Prior to scheduling or delivering End User training, Contractor shall confirm that:

1. Closeout submittals have been accepted by Owner and Consultant.

2. Final closeout inspection has been completed and punch list items rectified.

3. Training schedule dates have been coordinated with and approved by Owner and Consultant.

D. Training shall include:

1. Approved handouts.

2. Practical and comprehensive operation of systems.

3. Basic system troubleshooting techniques.

4. Basic system maintenance.

E. Training Blocks

1. Training time is defined as those hours specifically set aside for the sole purpose of training end users. Credited time will not be given for any time spent providing instructions to the Owner's staff for a system not completed or that has not passed final acceptance by the Owner and Consultant, or training performed outside of the approved training program.

2. This training will be divided into training session "Blocks" as coordinated with the Owner.

a. The first training session block shall consist of training intended for the common system operators. Such training, at a minimum, shall include the day to day use of the system.

b. The second training session block shall consist of training administrators of the day to day administration of the system. Such training, at a minimum, shall include use of the administration control functions of the systems, user setup, and filtering and pulling reports.

c. The third training session block shall consist of training administrators on system troubleshooting, maintenance, and updates. Such training, at a minimum, shall include using the system tools to diagnose issues, diagnosing common physical equipment issues, performing simple maintenance, and performing system updates.

d. The forth training session block shall consist of a training session structured for high-level users, for example staff trainers who will provide instruction to other users and will include advance system configuration and operational knowledge needed to maintain and manage all specified technology systems. The Contractor may elect to engage the Manufacturer(s) in certifying the high-level end users in the systems at no cost to the Owner.

F. The Contractor shall issue a certificate of training completion to the trainees upon completion of their training. Such certificates must be signed by both the trainer and trainee(s) for the Contractor to receive training credit.

3.24 Warranty and Maintenance Program

A. Contractor shall provide a warranty conforming to the stipulations below in addition to specific requirements identified in subsequent sections.

B. As part of the base proposal cost, the Contractor shall include a 1-year turnkey warranty period with full support costs.

1. Pricing for warranty services to be provided in years two through five shall be itemized on the Contract's Unit Pricing Form as part of a complete response. The Owner may fund the additional warranty services separately or not at all at the Owner's discretion.

C. The Warranty period shall begin after all punch list items have been rectified. The Contractor shall receive a letter of completion from the Consultant and Owner indicating project completion and starting the warranty period.

D. The warranty and support work included in this contract shall cover the following materials, software, and services, without additional cost to the Owner:

1. Inspections, preventative maintenance, and testing of equipment and components. The Contractor shall schedule a 10-month on-site preventative system review 10-months into each year of warranty and support including system inspections, preventive maintenance, software upgrades/patches, and testing of equipment and components.

2. Regular Service, Emergency Service, and Normal Service.

3. Labor, travel, equipment, materials, and transportation cost for all services covered by this warranty.

E. Response Time: Contractor shall respond to calls for warranty services in a timely manner as delineated below.

1. The Owner reserves the right to make the final determination of emergency or normal service calls and the right to coordinate the best times for service of any system failure.

2. Emergency service calls are defined as failures which prohibit the use of a typical system function(s) and pose a life safety concern, or such failures which cause a major impact to the Owner's daily operations.

a. The Contractor shall provide remote service diagnosing the impact within two (2) hours after notification by the Owner.

b. If remote service does not correct the reported issue, the Contractor shall provide on-site service correcting the impact within four (4) hours after notification by the Owner.

3. Normal service calls are defined as failures which prohibit the use of typical system function(s) but which do not inhibit critical system usage, do not pose life safety concerns, and do not create a major impact to Owner's daily operations.

a. The Contractor shall provide remote service correcting the impact within twenty-four (24) hours after notification by the Owner.

b. If remote service does not correct the reported issue, the Contractor shall provide on-site service correcting the impact within forty-eight (48) hours after notification by the Owner.

4. The Contractor shall supply Service Request forms and or proper contact procedure to the Owner with instructions for proper notification of the Contractor for warranty service. By following said instructions, the Owner shall constitute proper notification for any needed warranty service

F. Repair Time: Contractor shall locally stock critical parts in sufficient quantities such that emergency repair or replacement shall be guaranteed within twelve (12) hours. Temporary replacements within this time period shall be acceptable, provided temporary replacements do not compromise system functionality and provided permanent replacement is achieved within ninety-six (96) hours. Contractor may contact the Owner for use of Owner supplied spare parts where delay of system repair will have negative impact on system performance.

G. Transmittal: A copy of this Warranty shall be delivered to and signed for by the Owner's representative whose primary responsibility is the operation and care of these systems. A copy of the signed Warranty document shall be delivered for review as part of the Final Submittals.

H. Registration: Contractor shall register Warranty papers for all equipment and software in the name of the Owner and furnish reproductions of all equipment Warranty papers to the Owner with the Final Submittals.

I. Subcontracting: Warranty service work may not be subcontracted except with specific permission and approval by the Owner.

1. Service/Warranty Procedures: Contractor shall submit a warranty service plan containing all contact information and Owner service call directions for Owner review with project close-out submittals.

J. Resolution of Conflicts:

1. The Owner retains the right to resolve unsatisfactory warranty service performance at any time by declaring the work unsatisfactory and stating specific areas of dissatisfaction in writing.

2. If the Contractor or his approved Subcontractor does not resolve such stated areas of dissatisfaction within ninety-six (96) hours, the Owner may appoint an alternative service agency or person to fulfill the terms of the Warranty at the expense of the Contractor. This action may be taken repeatedly until the Owner is satisfied that Warranty service performance is satisfactory. Satisfactory resolution of a malfunction shall be considered adequate when the device, equipment, system or component which is chronically malfunctioning is brought into compliance with the standards of performance as contained herein and published by the manufacturers of the equipment installed.

End of Section

27 05 00 – COMMUNICATIONS GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the products and execution requirements related to furnishing and installing Category 5e/6/6a Cabling and Termination Components and related subsystems as part of a Structured Cabling System.

C. Backbone system comprising copper and fiber optic cabling and horizontal (station) cabling is covered under this document.

D. Others will provide the network electronics for the LAN within the Telecom Rooms (TRs) and will be responsible for connecting the new cabling infrastructure to the LAN. The Contractor, however, shall supply the patch cords. The Contractor shall be available on site during the crossover to assist with any cabling issues that may occur during the connection.

E. The Electrical Contractor shall install conduits and surface raceway for new technology outlet locations unless otherwise noted.

F. The Telecommunication Contractor shall provide and install all sleeves through the wall penetrations as required whether or not specifically marked on Project Drawings, unless otherwise noted.

G. All cables and related terminations support, and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Contractor, as detailed in the following section(s).

H. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association, the Electrical Code in the state where the work is to be performed, and present manufacturing standards.

I. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

1.2 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 23 – Pathways for Technology Systems

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 11 00 – Communications Equipment Rooms

E. Section 27 13 00 – Communications Backbone Cabling

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 16 00 – Communications Connecting Cords

H. Section 27 18 00 – Communications Labeling and Identification

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 60 00 – Physical Security General Requirements

K. Section 27 62 00 – Electronic Access Control System

L. Section 27 64 00 – Video Surveillance System

1.3 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.4 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

B. All references relate to the current version adopted by the city/county according to the authority having jurisdiction (AHJ). If the city/county has not adopted a version the latest version shall be utilized.

C. ASTM B633: Specification for Electrodeposited Coatings of Zinc on Iron and Steel

D. ASTM A653: Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process

E. ASTM A123: Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel

F. ASTM A510: Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

G. ANSI/TIA 569-C: Telecommunications Pathways and Spaces

H. ANSI/TIA 568-C.0, 1, 2, 3, 4: Commercial Building Telecommunications Standard

I. ANSI/TIA-598-C-2005 – Optical Fiber Cable Color Coding

J. ANSI/TIA 606-B: Administration Standard for Telecommunications Infrastructure

K. ANSI/TIA 942-A: Telecommunications Infrastructure Standard for Data Centers

L. ANSI/TIA 607-B: Generic Telecommunications Grounding (Earthing) and Bonding for Customer Premises

M. IEEE: National Electrical Safety Code® (NESC®)
standards.ieee.org/about/nesc

1.5 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

B. Premises Distribution System: Written certification that the premises distribution system complies with the EIA ANSI/TIA/EIA-568-C.0,1, 2, 3, EIA ANSI/TIA/EIA-569-B, and ANSI/TIA/EIA-606-A.

C. Materials and Equipment: Where materials or equipment are specified to conform, be constructed, or be tested to meet specific requirements, Contractor shall supply, upon request by Consultant or Owner, certification that the items provided conforms to such requirements. Certification by a nationally recognized testing laboratory that a representative sample has been tested to meet the requirements,

or a published catalog specification statement to the effect that the item meets the referenced standard, will be acceptable as evidence that the item conforms. Compliance with these requirements does not relieve the Contractor from compliance with other requirements of the specifications.

D. Certifications

1. The Contractor shall have an RCDD (Registered Communication Distribution Designer) on staff assigned to manage this Project; documented proof shall accompany the proposal response.

2. All installing personnel shall have completed and be certified in manufacturer training or BICSI (Building Industry Consulting Service International) installation training for UTP infrastructure systems, or the Contractor shall contract with manufacturer for installation of all proposed components. Company Certifications shall accompany the proposal response.

3. The Contractor's technicians shall be certified and trained in the connectivity hardware which is being installed.

4. The Contractor shall submit certification that installers are factory certified to install and test the provided products. No less than half of the crew to be used for the telecommunications installation shall be trained by that manufacturer for the work.

1.6 Pre-Construction Submittals

A. Shop Drawings in addition to requirements in Section 27 00 00:

1. Equipment rack elevation details

2. Elevations of telecommunication room walls with planned mounted equipment

3. Outlet faceplate details for all outlet configurations, sizes, and cable types

4. Overhead telecommunication room enlargements, providing dimensions of room and clearance for maintenance and operation

1.7 Construction Progress Submittals

A. Refer to Section 27 00 00 for requirements.

1.8 Closeout Submittals

A. Refer to Section 27 00 00 for requirements.

1. Data cable test results

2. CD containing:

a. As-built drawings (CAD format)

b. As-built drawings (PDF format)

c. Detailed test results in original tester format (e.g. Fluke Linkware)

d. Detailed cable test results in PDF format

3. Warranty certification from connectivity manufacturer

1.9 Delivery, Storage, and Handling

A. Contractor shall be responsible for all materials until completion of Project.

B. Cable shall be stored according to manufacturer's recommendations at minimum. In addition, cable shall be stored in a location protected from vandalism and weather.

C. If cable is stored outside, it shall be covered with opaque plastic or canvas with provision for ventilation to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees Fahrenheit, the cable shall be moved to a heated (minimum 50 degrees Fahrenheit) location. If necessary, cable shall be stored off site at the Contractor's expense.

D. If the Contractor wishes to have a trailer on site for storage of materials, arrangements shall be made with the Owner.

E. Commercial off-the-shelf manuals shall be furnished for operation, installation, configuration, and maintenance for all products provided as a part of the premises distribution system. Specification sheets for all cable, connectors, and other equipment shall be provided.

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Fire Stopping Materials

A. Refer to Section 27 00 00 for additional requirements.

PART 3 - EXECUTION

3.1 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.2 Training

A. Refer to Section 27 00 00 for additional requirements.

3.3 Warranty

A. Refer to Section 27 00 00 for additional requirements.

B. The Contractor shall provide to the Owner a manufacturer's 15-year minimum warranty certificate for all materials, equipment, etc. Upon successful completion of the installation and subsequent inspection, the Owner shall receive the numbered certificate from the manufacturing connectivity hardware (patch panels, jacks, parch cords 110 blocks, etc.) company registering the installation. This warranty shall include all labor, materials, and travel time.

C. The warranty shall ensure against product defects and guarantee that all approved cabling components exceed the specifications of TIA/EIA-568-C and ISO/IEC IS 11801 for cabling links/channels, and that the installation will exceed the loss and bandwidth requirements of TIA/EIA 568-C ISO/IEC IS 11801 for fiber links/channels for a fifteen (15) year period. The warranty shall apply to all passive structured cabling system components.

D. The warranty shall cover the failure of the wiring system to support the application that it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that use the TIA/EIA 568-C or ISO/IEC IS 11801 component and link/channel specifications for cabling. Such warranty shall apply for a minimum of a fifteen (15) year period.

E. The warranty shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective products(s), labeling of the new components, and testing of the circuit(s) at no cost to the Owner.

3.4 Examination

A. Verification of Conditions: Contractor shall examine areas and conditions under which work is to be performed and identify conditions detrimental to proper and timely completion.

B. Contractor shall verify that cable lengths comply with published standards.

C. Contractor shall notify Owner of any proposed installation which is expected to exceed maximum lengths prior to installation of cable.

D. Contactor shall consult with Owner regarding alternative routing or location of cable.

E. Contractor shall not proceed until unsatisfactory conditions have been corrected.

3.5 Spare Parts

A. Suggested List: Contractor is requested to submit a list of suggested spare parts with an offered price, allowing Owner to select appropriate parts.

B. Means of Obtainment: Contractor shall state where spare parts can be obtained after the installation.

3.6 Installation Requirements

A. Refer to Section 27 00 00 for additional requirements.

3.7 Cooperation

A. The Contractor shall cooperate with other trades and General Contractor's personnel in locating work in a proper manner.

B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

3.8 Testing and Acceptance

A. The Contractor shall perform acceptance tests as indicated below for each subsystem (backbone, station, etc.) as it is completed.

B. The Contractor shall supply all equipment and personnel necessary to conduct the acceptance tests. Prior to testing, the Contractor shall provide a summary of the proposed test plan for each cable type, including equipment to use, setup, test frequencies or wavelengths, results format, etc. The Consultant will approve the method of testing.

C. The Contractor shall visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. The Contractor shall provide the Consultant with a written certification that this inspection has been made.

D. The Contractor shall conduct acceptance testing according to a schedule coordinated with the Consultant. Representatives of the Owner may be in attendance to witness the test procedures. The Contractor shall provide a minimum of one (1) week advance notice to the Consultant and Owner to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.

E. Tests related to connected equipment of others shall be done only with the permission and presence of Contractor involved. The Contractor shall ascertain that testing only as required to prove the wiring connections are correct.

F. The Contractor shall provide Consultant with test results and descriptions of the testing methodology, including the date of the tests, the equipment used, and the procedures followed. At the request of the Consultant, the Contractor shall provide copies of the original test results.

G. All cabling shall be 100% fault free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the Contractor's expense. The applicable tests shall then be repeated.

H. Backbone voice cables shall be free of shorts within the pairs and be verified for continuity, pair validity and polarity, and conductor position on the termination blocks (e.g., 110). Any mispositioned pairs shall be identified and corrected. The percentage of "bad" pairs shall not exceed 1% in any backbone (riser or tie) cable based on total pair count. All bad pairs shall be identified and documented.

I. The Consultant or Owner may request that a 10% random field re-test be conducted on the cable system to verify documented findings.

1. If requested, the Contractor shall test up to 10% of cable links at no cost to the Owner.

2. Tests shall be a repeat of those defined above and under Testing and Acceptance. If findings contradict the documentation submitted by the Contractor, additional testing shall be performed to the extent determined necessary by the Consultant, including a 100% re-test. This re-test shall be at no additional cost to the Owner.

3.9 Fire Stopping

A. Contractor shall seal any openings created for cable pass-through between floors or through fire rated walls. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Creation of such openings as are necessary for cable passage between locations as shown on the Drawings shall be the responsibility of the Contractor. Any openings created by or for the Contractor and left unused shall also be sealed as part of this work.

End of Section

27 05 23 – PATHWAYS FOR TECHNOLOGY SYSTEMS

PART 1 - GENERAL

1.1 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.
2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.
3. Execution: Coordination, testing, training, warranty, and cable management.

1.2 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 26 – Grounding and Bonding for Technology Systems

D. Section 27 11 00 – Communications Equipment Rooms

E. Section 27 13 00 – Communications Backbone Cabling

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 16 00 – Communications Connecting Cords

H. Section 27 18 00 – Communications Labeling and Identification

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Wire Basket Tray Runway

A. As shown on the Project Drawings, the Contractor shall provide and install sufficient wire basket tray runway systems to support horizontal cable bundles.

B. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install complete wire basket tray runway systems.

C. Wire basket runway systems shall include, but are not limited to, straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports, and accessories.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. Contractor shall ensure that all straight section longitudinal wires are installed with no bends, kinks, or twisting.

F. Wire basket runway shall be made of high strength steel wires and formed into a standard 2-inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along runway sides (flanges) shall be rounded during manufacturing to prevent damage to cables and injury to installers.

G. All fittings shall be field formed as needed.

H. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel. Splicing assemblies shall provide a continuous ground connection.

I. Wire Basket Tray shall be grounded only at the Telecommunications Room ground bus bar.

J. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray to tray or tray to conduit or sleeve of varying elevations the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

K. T-sections of tray shall be made using T-section fittings.

L. Straight section splices shall be made using splice plates.

M. Wire basket runway supports shall be of the trapeze hanger type.

N. Trapeze hangers shall be supported by 3/8 inch diameter rods.

O. Tray shall have an electro zinc finish or a flat Black finish wherever finished installation will be visible to end users.

P. Accessories (connectors, splice plates…) shall be painted to match tray finish.

Q. Contractor shall refer to project drawings for cable tray sizing.

R. Manufacturer: Cable trays and accessories shall be of one of the following manufacturers

1. Cooper B-Line
2. Legrand Cablofil
3. Pentair Hoffman
4. Or approved equal

2.3 Cable Hook Systems

A. In the areas where the cables are required to be run in a “free-air” plenum, a cable hook system shall be used.

B. Cable hooks shall be capable of supporting a minimum of 30 lbs. with a safety factor of 3.

C. Spring steel cable hooks shall be capable of supporting a minimum of 100 lbs. with a safety factor of 3 where extra strength is required.

D. Cable hooks shall be Category 6a or better rated.

E. Follow manufacturer's recommendations for allowable fill capacity for each size of cable hook.

F. Installation and configuration shall conform to the requirements of the ANSI/ EIA/TIA Standards 568A & 569, NFPA 70 (National Electrical Code), and applicable local codes.

G. Cable hooks shall:

1. Have a flat bottom and provide a minimum of 1 5/8" cable bearing surface.
2. Have 90-degree radiused edges to prevent damage while installing cables.
3. Be designed so the mounting hardware is recessed to prevent cable damage.
4. Have a steel cable latch retainer to provide containment of cables within the hook.
5. Have a retainer that shall be removable and reusable.
6. Be factory assembled for direct attachment to walls, hanger rods, beam flanges, purlins, strut, and floor posts, to meet job conditions.

H. Factory assembled multi-tiered cable hooks shall be used where required to provide separate cabling compartments, or where additional capacity is needed.

I. Cable hooks for non-corrosive areas shall be pre-galvanized steel, ASTM A653 G90. Where additional strength is required, cable hooks shall be spring steel with a zinc-plated finish, ASTM B633, SC3.

J. Cable hooks for corrosive areas shall be stainless steel, AISI type 304.

K. Cable hooks shall be B-Line series BCH21, BCH32 or other manufacturer that meets these specifications

2.4 Surface Raceway

A. In areas where surface raceway will be used as a cable path, no exposed cable shall be permitted.

B. With the agreement of the Consultant and Owner, where telecommunications outlets are to be located in areas where the walls cannot be fished, the station wire serving these outlets shall be covered with raceways. No exposed wire shall be permitted within offices, laboratories, conference rooms, or like facilities. Contractor shall attempt to fish hollow walls, use existing conduit, or exhaust all other options to conceal cabling prior to installing surface raceway.

C. The raceway shall originate from a surface mounted box located off the floor, be attached to the wall, and terminate above the ceiling. The outlet box height shall match existing electrical receptacle height. Raceway for wall-mounted phone locations shall originate from a surface mounted box with the top of the box located 48" off the floor.

D. Raceway finish shall match finish of project electrical raceway. All fittings including but not limited to extension boxes, elbows, tees, and fixture boxes shall match the color of the raceway.

E. Telecommunication outlet faceplates shall match electrical faceplate standards for finish.

F. The raceway and all system devices shall be UL listed, exhibit nonflammable self-extinguishing characteristics, tested to specifications of UL94V-0, and be Category Compliant as defined by TIA/EIA 568.

G. Raceway turns or bends shall conform to manufacturer specifications or recommendations and industry best-practices for UTP and fiber optic cable minimum bend radius.

H. Non-Metallic raceway systems:

1. Non-metallic surface raceway shall have an adhesive-applied base and have a hinged snap-on cover. The raceway shall be manufactured of natural PVC compounds.

2. The raceway system shall be made up of the following components:

a. Raceway channel shall be Panduit LD5.

b. Surface mount outlet boxes shall be Panduit JBX3510EI-A.

c. Dropped ceiling connectors shall be Panduit DCF5EI-X or DCEFXEI-X.

d. Right angle fittings shall be Panduit RAFC5EI-X.

e. Coupler fittings shall be Panduit CFX5EI-X.

I. All raceway systems shall be installed complete as specified herein and in manufacturer recommendations.

2.5 Cable Pathway Sleeves

A. The Contractor shall only provide when re-enterable sleeves are not possible.

B. The Contractor shall provide all necessary wall penetration for cable pathways whether or not specifically shown on Project Drawings.

C. All wall penetrations shall have a metallic sleeve(s) as required to maintain a maximum 40% fill ration.

D. All sleeves shall be properly firestopped by this Contractor.

E. Contractor shall provide all core holes, pathways and sleeves (minimum 1.25" c).

F. Contractor shall install non-metallic threadless insulating bushings on end of all conduits.

G. Conduit Core Holes and Sleeves thru Floor: For all floor penetrations, Contractor shall provide IMC conduits with threaded steel couplings set flush with finish floor. Extend 6” above finish floor with IMC before any termination.

2.6 Re-Enterable Firestop Sleeves

A. TBD

B. Manufacturer:

1. STI EZ Path

2. Hilti Speedsleeve

3. Or approved equal

2.7 Metal Conduits and Fittings

A. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with TIA-569-B.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. EMT: Comply with ANSI C80.3 and UL 797.
5. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
    a. Fittings for EMT:
        i. Material: Steel
        ii. Type: Setscrew
6. Expansion Fittings: Steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

2.8 Outlet Boxes

A. General Requirements for Outlet Boxes

1. Comply with TIA-569-B.

B. Metallic outlet boxes and device covers shall be galvanized steel not less than 1/16'' thick.

C. The dimensions of the metallic outlet box shall be 2''x4'', 4''x4'' and 6''x4'' with a minimum depth of 2.5''. See drawings for details.

D. Metallic outlet boxes shall be equipped with single device cover (or two-device cover where needed).

E. Where installed in plaster, gypsum board, etc., covers shall be raised to compensate the thickness of the wall.

F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

G. Where metallic outlet boxes are to be empty for future use, blank covers shall be used.

H. Gangable boxes are not allowed.

2.9 Jail/Detention Center Appropriate Fittings, Connectors, Boxes and Support Hardware

A. All fittings, conduit, boxes and anchoring hardware must be secure to building structure and design and installed in a manner that inmates are unable to remove materials.

B. All fitting, conduit, boxes and anchoring hardware must be designed and installed to ensure no sharp corners of edges can be used to injury inmates or jail staff.

C. All surface mounted backboxes shall have no exposed knockouts or removable objects.

D. All accessible equipment and exposed screws shall use a Torx security screw.

E. All accessible screw connections in inmate cells, holding cells or other areas of risk shall be secured with Blue Loctite.

2.10 Jail/Detention Security Caulking

A. All conduits, fitting, cameras, intercoms or other miscellaneous items that pose a potential ligature risk or where inmates are not under direct supervision such as cells, holding cells, bathrooms or other areas of risk shall have all edges sealed with a flexible, tamper proof security caulk with a Shore A hardness of 80+. Inaccessible areas 10’ AFF shall be sealed with a tamper resistant security caulk with a Shore A hardness of 50. Inaccessible is defined as an area where an inmate cannot reach even while standing on fixtures, furniture, rails, ect.

PART 3 - EXECUTION

3.1 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.2 Training

A. Refer to Section 27 00 00 for additional requirements.

3.3 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.4 Wire Basket Tray Runway

A. Basket tray shall be installed in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of NEC, applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

B. Coordinate installation of wire basket runway with other electrical work as necessary to properly interface installation of wire basket runway with other work.

C. Provide sufficient space encompassing wire basket runways to permit access for installing and maintaining cables.

D. Test wire basket runways to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified maximum grounding resistance.

3.5 Cable Hook System

A. J-hooks fabricated to contain data/voice and video cables may be used to support 25 or fewer cables in each hook. J-hooks are to be fastened to building steel with beam clamps, suspended from ceiling slab with threaded rod, or anchored to the wall. All J-hooks shall be hung straight and level. No other installation technique will be authorized unless pre-approved.

B. Three tiered double-sided J-hook configurations shall contain a maximum of 25 cables per hook or 150 cables. Smaller configurations may be used as bundles decrease in size, maintaining no more than 25 cables per hook.

C. Bundles surpassing 150 cables shall be supported by hangers, fabricated of 3/8" threaded rod and 24" Unistrut. Hangers shall also be installed where the installation of a three-tiered J-hook system is not appropriate for the ceiling space, or where blocked by other trades' work.

D. Cable bundles consisting of fewer than 10 cables may be supported by single J hooks.

E. All cable support in the main cable path shall be installed every four feet. Small cable bundles (under 25) not in the main path may be supported every five feet.

F. A sag shall be maintained between supports of 6", to reduce cable strain. Velcro is an appropriate method of securing cables, when properly used and not over tightened.

G. Proper cable support is extremely important to the Owner, and care shall be taken by the Contractor to provide and install the appropriate supports. Supports found to be inadequate will be replaced.

H. Cable bundles including voice/data cabling shall not have plastic cable ties.

I. All cable trunks shall have radius controlled cable waterfalls where trunk drops from conduit, sleeve or tray from horizontal path to vertical path.

3.6 Surface Raceway System

A. In areas where surface raceway will be used as a cable path, no exposed cable shall be permitted.

B. With the agreement of the Consultant and Owner, if a telecommunications outlet is required in an area where the walls cannot be fished, the station cable serving these outlets shall be covered with raceway. No exposed cable shall be permitted within offices, laboratories, and conference rooms, or like facilities. Contractor shall attempt to fish hollow walls, use existing conduit, or exhaust all other options to conceal cabling prior to installing surface raceway.

C. The raceway shall originate from a surface mounted box located off the floor and be attached to the wall and terminate above the ceiling. The outlet box height shall match existing electrical receptacle height. Raceway for a wall-mounted location shall originate from a surface mounted box with the top of the box located 48" off the floor.

D. Minimum bend radius shall be adhered to for UTP and fiber optic cable.

E. Where raceway is to be installed on painted, smooth, finished surfaces, the Contractor shall clean surface prior to installing raceway.

F. Where non-metallic raceway is to be installed on non-smooth surfaces such as wallpaper, unpainted brick, concrete, etc., the Contractor shall use flat-head screws in addition to the adhesive backing to fasten channel to surfaces.

G. Where Contractor is required to install metallic raceway, the raceway base shall be installed using flat-head screws and following all manufacturer's recommendations.

H. Where new outlet locations are indicated on Project Drawings as having existing Wiremold™ type raceway, the Contractor shall remove existing raceway from wall and install new specified raceway to cover any damage or markings caused from removing existing raceway product.

I. All surface raceway shall be mounted level and plumb. Where the Owner considers raceway channels to be installed unsatisfactorily, the Contractor shall remove and replace necessary channels at no additional cost to the Owner.

J. Suitable insulating bushings and inserts shall be used at connections to outlets and corner fittings. Dropped ceiling end fittings shall be utilized where raceway channel connects to dropped accessible ceiling tile. In rooms with drywall ceilings, open ceilings, or non-accessible ceilings, the Contractor shall extend raceway to the nearest location, hallway, or corridor that has accessible ceiling cavity. All cables shall be concealed.

3.7 Pathway Applications

A. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT

2. Concealed in Ceilings and Interior Walls and Partitions: EMT

B. Minimum Pathway Size for Data: 1-inch trade size. Cable fill shall not exceed a 40% fill ratio.

C. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.

3.8 Installation

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

C. Complete pathway installation before starting conductor installation.

D. Arrange stub-ups so curved portions of bends are not visible above finished slab.

E. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

G. Support conduit within 12 inches of enclosures to which attached.

H. All conduit penetrations shall comply with all applicable fire codes. All conduit penetrations in fire-rated walls or floors shall be sealed and fire proofed to at least the rating of the penetration area.

I. Conduits shall be routed in the most direct route, with the fewest number of bends.

J. There shall be no continuous conduit sections longer than 100 feet. For runs that total more than 100 feet, insert junction or pull boxes (or gutters if appropriate) so that no continuous run between pull boxes is greater than 100 feet.

K. There shall be no more than two 90-degree bends (180 degrees total) between conduit pull boxes.

L. Changes in direction shall be accomplished with sweeping bends observing minimum bend radius requirements above. Do not use pull boxes for direction changes unless specifically designated otherwise in the Drawings.

M. Stub-ups to Above Recessed Ceilings:

1. Use EMT for pathways.

2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

O. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

R. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb. tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

3.9 Outlet Boxes

A. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

B. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.

C. The approximate locations of the outlets are indicated on the drawings. The exact locations shall be determined at the building. The right is reserved to change without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

D. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a rain tight connection between box and cover plate or supported equipment and box.

E. Horizontally separate boxes by a minimum of 12" mounted on opposite sides of walls so they are not in the same vertical channel.

F. Outlet boxes installed back to back in fire-rated walls shall be separated horizontally by a minimum of 24".

G. Install all outlet boxes in finished areas flush with the wall. Maintain ¼" or less space between outlet box front and finished wall surface.

H. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

I. Outlet boxes shall be firmly anchored in place and shall not depend on the cover plate to hold it secure to the wall.

J. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

K. Any surface boxes shall have rounded corners and edges. Surface boxes must be approved by Owner prior to installation.

3.10 Riser Conduits

A. Conduits entering equipment rooms shall be reamed or bushed and terminated not more than 4" from a wall and within 12” of room corners.

B. Conduits entering equipment rooms from below floor shall be terminated not more than 4" above finished floor.

C. Conduits shall not be less than 4" trade size and be equipped with a measured pull line at 12” increments rated at a minimum 1200 pound test.

D. Provide restorable fire stops inside and around conduits as recommended by UL1479 or ASTM E814 for all conduits penetrating fire-rated construction.

E. Provide an insulating press fit bushing on all telecommunications riser conduits. Bushings must be rated to be used in an environmental air handling space (Plenum).

3.11 Sleeve-Seal Installation for Communications Penetrations

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.12 Firestopping

A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

End of Section

27 05 26 – GROUNDING AND BONDING FOR TECHNOLOGY SYSTEMS

PART 1 - GENERAL

1.1 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.
2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.
3. Execution: Coordination, testing, training, warranty, and cable management.

1.2 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 23 – Pathways for Technology Systems

D. Section 27 11 00 – Communications Equipment Rooms

E. Section 27 13 00 – Communications Backbone Cabling

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 16 00 – Communications Connecting Cords

H. Section 27 18 00 – Communications Labeling and Identification

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

1.3 Reference Standards and Codes

A. IEEE C2 - National Electrical Safely Code

B. IEEE Std. 837-2002, or latest version – Standard for Qualifying Permanent Connections Used in Substation Grounding

C. ANSI/TIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications

D. NFPA 70E - Standard for Electrical Safely in the Workplace

E. ANSI/NECA/BICSI-607 - Telecommunications Bonding and Grounding Planning and Installation methods for Commercial Buildings

F. UL 467 - Standard for Grounding and Bonding Equipment

G. Refer to Section 27 00 00 for additional requirements.

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Grounding and Bonding Cable

A. The grounding and bonding cable shall be stranded copper conductors.

B. The grounding and bonding cables shall have a green jacket color and riser or plenum rated as required.

C. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications, or as required by NFPA 70, whichever is larger. Differentiate between normal ground and isolated ground when both are used within the same facility.

2.3 Grounding and Bonding Busbars

A. Telecommunications Main Grounding Busbar (TMGB)

1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.
2. 0.25” thick x 4” wide
3. Sized for current applications and future growth, no less than 18”
4. Insulated from its support
5. Shall be an electro-tin plated busbar
6. Maintain a minimum of 2” of clearance from wall
7. UL listed and BICSI certified

B. Telecommunications Grounding Busbar (TGB)

1. Factory-drilled solid copper with holes to accommodate lugs. Field manufactured busbars are not acceptable.
2. 0.25” thick x 4” wide
3. Sized for current applications and future growth, no less than 12”
4. Insulated from its support
5. Shall be an electro-tin plated busbar
6. Maintain a minimum of 2” of clearance from wall
7. UL listed and BICSI certified

C. Horizontal Equipment Rack or Cabinet Busbar

1. Mounts to standard 19” Rack or Frame
2. Capacity: 6 Double hole lugs
3. Shall be an electro-tin plated busbar

4. UL listed and BICSI certified

D. Vertical Equipment Rack or Cabinet Busbar

1. Mounts to vertical rail or inside of cabinet in 19” or 23” equipment rack or frame.
2. Capacity: 9 Double hole lugs
3. Shall be an electro-tin plated busbar
4. UL listed and BICSI certified

2.4 Mechanical Connectors

A. Mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers, and lock washers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are not allowed.

C. Connectors shall meet or exceed UL 467.

2.5 Compression Lugs

A. Shall be UL & CSA listed

B. Shall meet or exceed the performance requirements of IEEE 837, latest revision

C. Compression type

D. Shall be manufactured from pure wrought copper. Conductivity of this material shall be no less than 99% by IACS standards.

E. Shall be electro-tin plated

F. Lugs shall be 2-hole. Single hole lugs are not allowed

G. Long barrel that will allow a minimum of two crimps with standard industry colors

H. Each connector shall be filled with an oxide-inhibiting compound

I. Crimped with a compression, tool and die system, according to manufacturer’s recommendation

2.6 Taps

A. Connections to the Conductor shall be made with irreversible compression connectors

B. Shall be UL & CSA listed

C. Requires a minimum of (2) crimps for C Tap or H Tap, 1 crimp for I-Beam and busbar Tap

D. Crimp according to manufacturer’s recommendation

PART 3 - EXECUTION

3.1 General

A. Install products in accordance with manufacturer’s recommendations.

B. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

C. Mechanical connections shall be accessible for inspection and maintenance.

D. No insulation shall be installed over mechanical ground connections.

E. Ground connection surfaces shall be cleaned and all connections shall be made so that disconnection or removal is impossible.

3.2 Resistance Measurement

A. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 2 ohms.

3.3 Telecommunications Bonding Backbone (TBB)

A. The intended function of a TBB is to reduce or equalize potential differences between telecommunications systems. While the TBB will carry some current under ac power ground fault conditions, it is not intended to provide the only ground fault return path.

B. The TBB shall:

1. Be connected to the TMGB & TGB.

2. Be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG. The TBB shall be sized in accordance to the following table:

Linear Length – ft.	Size (AWG)
Less than 13	6
14 - 20	4
21 - 26	3
27 - 33	2
34 - 41	1
42 - 52	1/0
53 - 66	2/0
Greater than 67’	3/0

3. The TBB conductors shall be installed and protected from physical and mechanical damage.

4. The TBB conductors should be installed without splices.

a. Where splices are necessary, the number of splices should be kept to a minimum and they shall be accessible and located within telecommunications spaces or j-box labeled as a telecommunications bonding backbone splice.

b. Joined segments of a TBB shall be connected using exothermic welding, irreversible compression-type connectors or equal.

C. A metallic cable shield shall not be used as a TBB.

3.4 Grounding Equalizer (GE)

A. The GE shall be a continuous copper conductor that shall be sized no less than 6 AWG to a maximum of 3/0 AWG. The GE shall match the size of the TBB.

B. The GE shall connect to the telecommunications grounding busbar(s) in the same-floor telecommunications rooms on the first, top, and every third floor in a building greater than 4 floors.

C. A metallic cable shield shall not be used as a GE.

3.5 Telecommunications Equipment Bonding Conductor (TEBC)

A. Connects the TMGB/TGB to equipment racks and cabinets.

B. Shall be a continuous copper conductor that shall be sized per the length of cable.

C. Shall be separated from ferrous materials by 2" or be bonded to the ferrous metal.

D. May be routed within cable trays or suspended 2" under or off the side of the cable tray or ladder rack.

E. Shall be supported every 3ft.

F. 8" minimum bend radius.

G. May come cross other cable groups at a 90 degree angle only.

H. A metallic cable shield shall not be used as a TEBC.

3.6 Rack or Cabinet Bonding Conductor

A. A bonding conductor shall be used to connect the equipment racks and cabinets directly to the TMGB, TGB or underfloor ground mesh network.

B. All metallic enclosures, including remote mounted equipment cabinets and racks for telecommunications, security or audio/visual shall be bonded to the nearest TMGB or TGB using a minimum sized conductor of 6 AWG. Remote bonds shall be labeled on both ends stating the destination of the bond.

3.7 Electrical Distribution Panel (EDP)

A. The AC EDP serving the Telecommunications Room shall be bonded to the TMGB or TGB using a minimum of a 6 AWG cable.

B. A qualified electrician shall make all connections within an AC electrical distribution panel.

3.8 Optical Fiber Conductive Cables

A. Conductive fiber-optic cables should be bonded and grounded as specified in the NEC.

3.9 Conduit and Sleeve Bonding

A. All conduits and sleeves entering a telecommunications room shall be grounded.

3.10 Ladder Rack and/or Cable Tray

A. All low voltage cable runway sections shall be bonded together and bonded back to the nearest Telecommunications Room the runway is serving as close TMGB or TGB as practical.

B. Maintain an 8" minimum bend radius on the TEBC.

C. Keep a 2" separation from other cables both power and telecommunications.

D. Remove any paint, oxidation, etc. from the runway surfaces that are being bonded.

E. Drill two holes as required to accommodate the 2-hole compression lug.

F. Apply a thin coat of antioxidant around the holes and on the surface where the lug will be in contact.

G. Attach straps to the runway using stainless steel hardware sized for the lug holes.

H. Wipe off any excess antioxidant after installation of the lug.

3.11 Building Steel

A. Each ground bus bar shall be bonded to building steel.

B. Remove any paint or fire stopping spray from the building steel.

C. Provide the appropriate bonding connector to connect to beams, trusses or other types of structure.

3.12 Labeling

A. Each grounding/bonding cable shall be labeled at the TMGB or TGB.

B. All taps to the TBB shall be within an enclosure and labeled as to its purpose.

C. Mechanical connectors shall be clearly marked with the catalog number, conductor size, and manufacturer.

D. Compression lugs shall be clearly marked with manufacturer, catalog number, conductor size, and required compression tool settings.

3.13 Testing

A. Refer to Section 27 00 00 for additional requirements.

B. Perform testing in accordance with test instrument manufacturer's recommendations using the fall-of-potential method.

3.14 Training

A. Refer to Section 27 00 00 for additional requirements.

3.15 Warranty

A. Refer to Section 27 00 00 for additional requirements.

End of Section

27 11 00 – COMMUNICATIONS EQUIPMENT ROOMS

PART 1 - GENERAL

1.1 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the products and execution requirements relating to telecommunications cabling, termination components, racks, pathways, telecommunication rooms and related subsystems. Covered systems include the following:

1. Equipment room cable management system and equipment racks
2. Horizontal and backbone cable terminating equipment
3. Telecommunications grounds and related components

1.2 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 23 – Pathways for Technology Systems

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 13 00 – Communications Backbone Cabling

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 16 00 – Communications Connecting Cords

H. Section 27 18 00 – Communications Labeling and Identification

I. Section 27 51 00 – Distributed Communications Systems

J. Section 27 60 00 – Physical Security General Requirements

K. Section 27 62 00 – Electronic Access Control System

L. Section 27 64 00 – Video Surveillance System

1.3 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.
2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.
3. Execution: Coordination, testing, training, warranty, and cable management.

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Category 6 Patch Panels

A. Cables shall be terminated at the telecommunication closets on high-density integrated patch panels incorporating Category 6 jacks (non-keyed 8-pin), meeting the specifications for the telecommunications outlet detailed in the section above.

B. Patch panel configuration shall be 48 ports.

C. The patch panel shall exceed ANSI/TIA/EIA 568-C.2-1 Category 6 component compliance standard. All pair combinations shall be considered, with the worst-case measurement being the basis for compliance.

D. The patch panels shall be interoperable and backwards compatible to lower performing cabling systems.

E. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers' minimum bend radius specifications are adhered to.

F. The patch panel shall have color-coded designation strips to identify cable count.

G. Manufacturers:

1. Leviton
2. Panduit
3. Uniprise

2.3 Category 6a Patch Panels

A. Cables shall be terminated at the telecommunication closets on high-density integrated patch panels incorporating Category 6a rated jacks (non-keyed 8-pin), meeting the specifications for the telecommunications outlet detailed in the section above.

B. Patch panel configuration shall be 48 ports.

C. Wireless access points shall be installed on their own dedicated patch panel at the top of the rack.

D. The patch panel shall exceed ANSI/TIA/EIA 568-C.1 Category 6a compliance standard. All pair combinations shall be considered, with the worst-case measurement being the basis for compliance.

E. The patch panels shall be interoperable and backwards compatible to lower performing cabling systems.

F. Panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers' minimum bend radius specifications are adhered to.

G. The patch panel shall have color-coded designation strips to identify cable count.

H. Manufacturers:

1. Leviton

2.4 Voice Backbone Termination Field

A. Wall Mounted 110 Blocks

1. At the MDF room or the primary distribution point for voice backbone cables shall be terminated on high-density wall mounted 110 blocks.

2. The panels shall incorporate the openings between rows to allow cables to be routed from behind the panel directly to the point of termination.

3. The panels shall be with cable managers and covers. Termination strips on the base shall be notched and divided into 5-pair increments and accommodate C5 clips.

4. The mechanical termination shall:

a. Have the ability of terminating 22-26 AWG plastic insulated, solid, and stranded copper conductors.

b. Provide a direct connection between the cable and jumper wires.

c. Have less than 0.2-dB of attenuation from 1 - 100 MHz.

d. Have less than 100 mw of DC resistance.

e. Have less than 5 mw of resistance imbalance.

f. Have minimal signal impairments at all frequencies up to 100 MHz.

5. Blocks shall identify pair position by a color designation: blue, orange, green, brown, and slate (backbone only).

2.5 Voice Patch Panels

A. At the MDF and each IDF the voice backbone cables originating from the primary distribution point shall be terminated on rack mounted voice patch panels.

B. Backbone cables 25-pair or less shall be terminated on 24-port patch panels and backbone cables greater than 25-pair shall be terminated on 48-port patch panels.

C. The voice patch panel shall utilize 25-pair Amphenol connectors on the rear and RJ-45 jacks on the front.

D. Manufacturers:

1. Leviton

2. Panduit

3. Uniprise

2.6 Fiber Optic Patch Panels

A. The Contractor shall provide a fiber optic patch panel at each location where a fiber optic cable terminates.

B. All terminated fibers shall be mated to duplex LC couplings mounted on enclosed patch panels. Couplers shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types, including SC, ST, Fixed Shroud Duplex (e.g., “FDDI Connector”), Biconic, and FC by changing panels on which connector couplings are mounted.

C. The patch panel enclosure shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and Drawings, including those not terminated (if applicable), PLUS 50% future growth.

D. The Contractor shall provide all required connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated.

E. Patch panels shall be designed for easy installation, front removal, and expansion of snap-in adapter panels.

F. Patch panels shall be enclosed assemblies affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to protect the connector couplings and fiber optic jumpers.

G. The patch panel's enclosure shall provide for strain relief of incoming cables and shall incorporate radius control mechanisms to limit bending of the fiber to the manufacturer's recommended minimums or 1.2", whichever is larger.

H. Access to the inside of the patch panel enclosure during installation shall be from the front and rear. Panels that require any disassembly of the cabinet to gain entry will not be accepted.

I. All patch panels shall provide protection to both the "facilities" and "user" side of the coupling. The patch panel enclosure shall be configured to require front access only when patching. The incoming cables (backbone, riser, etc.) shall not be accessible from the patching area of the panel. The enclosure shall provide a physical barrier to access of such cables.

J. Where singlemode fibers are installed, the fibers contained in these cables may be terminated either by (1) splicing of factory-terminated cable assemblies ("pigtails") or (2) use of a "fan-out" kit. In the latter approach, individual fibers are to be secured in a protective covering (such as an Aramid reinforced tube, for example) with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and subassemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.2 dB.

K. Fiber optic patch panels shall be Corning PCH-02 in TR/IDF and PCH-4U in MDF or Server Rooms or approved equal.

L. 50-micron LC adaptor panels shall be Corning CCH-CP12-E4 or approved equal.

M. Singlemode LC adaptor panels shall be Corning CCH-CP12-A7 or approved equal.

2.7 Cable Management System

A. The cable management system shall be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures. The system shall be a complete cable management system comprising 4-post and 2-post floor mount racks, wall mount racks, equipment cabinets and vertical and horizontal cable managers to manage cables on both the front and rear of the rack. The system shall protect network investment by maintaining system performance, controlling cable bend radius, and providing cable strain relief.

1. 4-Post Equipment Racks

a. The Contractor shall provide and install 4-post adjustable equipment racks to house cable termination components (e.g., copper data and fiber optic) and network electronics (by others) as shown on the Drawings. Prior to installation, the Contractor shall coordinate exact placement with Consultant and Owner.

b. Rack shall be 84" in height and shall be self-supporting.

c. Channel uprights shall be spaced to accommodate industry standard 19" mounting.

d. Rack shall be constructed of aluminum.

e. Rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per EIA/TIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.

f. Rack shall be supplied with at least 24 spare screws.

g. Rack shall be supplied with a vertical ground bar and #6 AWG ground lug.

h. Manufacturers:

i. Chatsworth #50120-703

ii. Ortronics

iii. Panduit

iv. Pentair Hoffman

v. Or approved equal.

2. 4-Post Server Racks

a. The Contractor shall provide and install 4-post adjustable server racks to house cable termination components (e.g., copper data and fiber optic), network electronics (by others) and servers as shown on the Drawings. Prior to installation, the Contractor shall coordinate exact placement with Consultant and Owner.

b. Rack shall be 84" in height and shall be self-supporting.

c. Channel uprights shall be spaced to accommodate industry standard 19" mounting.

d. Rack shall be constructed of aluminum.

e. Rack shall be double side drilled and tapped to accept square-punched .375” equipment mounting holes. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per EIA/TIA specifications (5/8"-5/8"-1/2").

f. Rack shall be supplied with at least 24 spare screws.

g. Rack shall be supplied with ground lugs.

h. Provide with cable waterfall and vertical cable managers

i. Contractor shall provide 100 cage nuts and screws with each rack.

j. Manufacturers:

i. Chatsworth #15253-B03

ii. Ortronics

iii. Panduit

iv. Pentair Hoffman

v. Or approved equal.

3. 2-Post Equipment Racks

a. The Contractor shall provide and install 2-post adjustable equipment racks to house cable termination components (e.g., copper data and fiber optic) and network electronics (by others) as shown on the drawings. Prior to installation, the Contractor shall coordinate exact placement with Owner.

b. Rack shall be 84" in height and shall be self-supporting.

c. Channel uprights shall be spaced to accommodate industry standard 19" mounting and have pass-through holes with smooth edges to protect cables.

d. Rack shall be constructed of aluminum.

e. Able to support up to 1,500 pounds.

f. Rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per EIA/TIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.

g. Rack shall be supplied with at least 24 spare screws.

h. Rack shall be supplied with a vertical ground bar and #6 AWG ground lug.

i. Manufacturers:

i. Chatsworth #55053-703

ii. Ortronics

iii. Panduit

iv. Pentair Hoffman

v. Or approved equal.

B. Vertical Cable Management

1. At the telecommunication rooms, vertical cable management shall be furnished and installed to adjacent racks to organize cables on front and rear of telecommunication racks.

2. Vertical cable managers shall include components that aid in routing, managing, and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" or 23" racks.

3. Vertical cable management system shall feature the following:

a. Open cabling section on the rear that provides easy access and routes cable bundles feeding into the back of patch panels and 1 RMU cable guide on the front designed for fanning and managing patch cords.

b. Edge-protected pass-through ports designed for easy routing of cable from front channel to back.

c. Vertical slots along the center separator to allow securing cable bundles neatly with management straps.

d. Door/cover (front only) that is easily opened from the right or left and still easily removed to allow for quick moves, adds, and changes.

e. Movable wire retainers to retain the cables during cover removal.

4. Vertical cable management at the end of rack rows shall be 6”.

5. Vertical cable management between racks shall be 10”

2.8 Power Devices

A. Refer to Section 27 00 00 for additional requirements.

B. Horizontal PDU, Single Circuit

1. Power strip shall provide 3,840 joules of surge protection and power conditioning.
2. Contractor shall provide one (1) power strip per rack/cabinet.
3. Power strip shall be rated for 20 amps.
4. Manufacturer:
   a. Tripp-Lite IBAR12-20ULTRA
   b. Or approved equal

C. Vertical PDU, Dual Circuit

1. Contractor shall provide one (1) power strip per server rack/cabinet.
2. Dual NEMA L5-20R or 5-20R (with included adapter) receptacle connections.
3. Single-Phase, Dual 20A Circuits, 3.8kW
4. 16 color coded outlets per circuit
5. Dual digital meters displaying amps.
6. Provide with appropriate rack mounting hardware.
7. Manufacturer:
   a. Tripp-Lite PDUMV40
   b. Or approved equal

2.9 Shallow Wall Mount Cabinet

A. Where Indicated on Project Drawings, the Contractor shall provide and install a shallow wall mount cabinet to house cable termination panels and network electronics. The Contractor shall also provide and install ¾" plywood backboard for support when mounting cabinet.

B. The Contractor shall coordinate with General Contractor to install power outlet into cabinet.

C. Cabinets housing active equipment shall be equipped with a fan and fan controller.

D. Manufacturers:

1. Hubbell RE4X
2. Or approved equal

2.10 Wall Mount Equipment Cabinet

A. Where indicated on Project Drawings, the Contractor shall provide and install wall mount cabinet to house cable termination panels and network electronics. The Contractor shall also provide and install one (1) ¾" plywood backboard for support when mounting cabinet.

B. The Contractor shall coordinate with Electrical Contractor to install a power outlet into cabinet.

C. Cabinets shall be equipped with fans and thermostatic fan controller.

D. Manufacturers:

1. Cabinet shall be Chatsworth 12419-736.

2. Cabinet shall be Chatsworth 12419-748.

2.11 Horizontal Cable Management

A. Horizontal cable managers shall include components that aid in routing, managing, and organizing cable to and from equipment. Panels shall protect network equipment by controlling cable bend radius and providing cable strain relief. Panels shall be a universal design mounting to EIA 19" racks and constructed of steel bases with PVC duct attached. The duct fingers shall include retaining tabs to retain the cables in place during cover removal. The covers shall be able to hinge from either side yet still be easily removed to allow for quick moves, adds, and changes.

B. The cable managers shall be provided with movable wire retainers to retain the cables during cover removal and #12-24 mounting screws. An integral strain relief bracket shall be provided on either end of the duct to allow for easy cover placement.

C. Double-Sided horizontal cable managers shall be placed above and below each patch panel.

D. The Contractor shall also supply (1) per 48-port patch panel additional managers for network electronics.

E. Manufacturers:

1. Chatsworth #30530-719

2. Ortronics

3. Panduit

4. Pentair Hoffman

5. Or approved equal.

2.12 Telecommunication Ground

A. The Telecommunication Contractor is responsible for providing an appropriate ground for all racks, trays, and telecommunications equipment installed by this Contractor. Refer to the Grounding and Bonding for Technology Systems specification section.

2.13 Wire Basket Runway Tray

A. Within each Telecommunications Room, the Contractor shall provide and install sufficient wire basket tray to support cable bundles from corridor to equipment racks or as shown on the Project Drawings, this Contractor shall provide and install sufficient basket tray to support cable bundles from corridor to equipment racks or cabinets.

B. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install complete wire basket runway systems in the telecommunication closet.

C. Wire basket runway systems shall include, but are not limited to, straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports, and accessories.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. All straight section longitudinal wires shall be straight (with no bends).

F. Wire basket runway shall be made of high strength steel wires and formed into a standard 2-inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along runway sides (flanges) shall be rounded during manufacturing for safety of cables and installers.

G. All fittings shall be field formed as needed.

H. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel. Splicing assemblies shall provide a continuous ground connection.

I. Wire Basket Tray shall be grounded to a Telecommunications Room ground bus bar.

J. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray and drop to the rack, cabinets or ladder rack, the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

K. T-sections of tray shall be made using T-section fittings.

L. Straight section splices shall be made using splice plates.

M. Wire basket runway supports shall be wall mounted brackets and trapeze hangers when spanning the room.

N. Trapeze hangers shall be supported by 3/8 inch diameter rods.

O. Provide size as indicated on the drawings.

P. Tray shall have flat Black finish.

Q. Accessories (connectors, splice plates…) shall be painted to match tray finish.

R. Manufacturer:

1. Cooper B-Line
2. Legrand Cablofil
3. Pentair Hoffman
4. Or approved equal

2.14 Ladder Rack

A. Within each Telecommunications Room, the Contractor shall provide and install ladder rack as shown on the Project Drawings.

B. Within each Telecommunications Room with a vertical conduit riser the Contractor shall provide and install vertical ladder rack connecting the ground conduit sleeve penetrations with the ceiling conduit sleeve penetrations.

C. The Contractor shall provide all necessary labor, supervision, materials, equipment, tests, and services to install a complete ladder rack system in the telecommunications room as shown on the Drawings.

D. Specifications and Drawings are for assistance and guidance, but exact routing, locations, distances, and levels will be governed by actual field conditions.

E. All splicing assemblies shall be the bolted type using serrated flange locknuts. Hardware shall be either yellow zinc dichromate in accordance with ASTM B633 SC2 or AISI Type 304 stainless steel.

F. Cable Drop Out/Waterfall

1. Where cables bundles transition from tray and drop into the racks/cabinets, the Contractor shall provide and install a radius control device. This device shall be a waterfall or drop out device and shall be properly sized to accommodate cable bundle plus 20% future growth.

G. Size ladder rack as indicated on the Contract Documents.

H. Accessories (connectors, splice plates…) shall be painted to match tray finish.

I. Manufacturers:

1. Chatsworth
2. Cooper
3. Legrand
4. Pentair Hoffman
5. Or approved equal

PART 3 - EXECUTION

3.1 Equipment Rack and Cabinets

A. Prior to permanently securing racks or cabinets, the Contractor shall coordinate a walk through with the Owner to determine exact placement of racks.

B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. Rack shall also be stabilized by extending a brace extending to the wall. Alternately, overhead cable tray over which the cabling accesses the equipment rack(s) shall provide this function.

C. A space between the rack upright and the wall (~6") shall be planned to allow for cabling in that area. The rear of the rack shall be ~40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed shall be brought to the attention of the Consultant for resolution prior to installation.

D. All hardware and equipment is to be mounted at least 18" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware shall be reviewed and approved by the Consultant and Site Coordinator(s) prior to installation.

E. Equipment rack shall be equipped with cable management hardware to allow an orderly and secure routing of twisted pair cabling to the data patch panels. At minimum, one such horizontal jumper management panel shall be placed below each fiber optic patch panel installed by the Contractor. Additional jumper management panels may be required pending installation of other cable types on the rack. The rack shall be grounded to the telecommunications grounding backbone (TGB) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket).

3.2 Wire Basket Tray and Ladder Rack Runway

A. Runway shall be installed in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of NEC, applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

B. Coordinate installation of runway with other electrical work as necessary to properly interface installation of wire basket runway with other work.

C. Provide sufficient space encompassing runways to permit access for installing and maintaining cables.

D. Test runways to ensure electrical continuity of bonding and grounding connections and to demonstrate compliance with specified maximum grounding resistance.

End of Section

27 13 00 – COMMUNICATIONS BACKBONE CABLING

PART 1 - GENERAL

1.1 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the products and execution requirements relating to telecommunications voice, data and video backbone cabling and termination components.

C. Backbone Cabling is the cable and hardware interconnecting telecommunication rooms (TRs), building demarcation rooms, equipment rooms and server rooms. The backbone cabling shall consist of the following cable types:

1. 50-micron Multimode Fiber Optic Cable
2. Singlemode Fiber Optic Cable
3. Multi-Pair Copper Voice Backbone Cable

1.2 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 23 – Pathways for Technology Systems

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 11 00 – Communications Equipment Rooms

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 16 00 – Communications Connecting Cords

H. Section 27 17 00 – CATV RF Distribution System

I. Section 27 18 00 – Communications Labeling and Identification

1.3 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.
2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.
3. Execution: Coordination, testing, training, warranty, and cable management.

1.4 Test Data – Fiber Optic Media

A. The test result information for each link shall be recorded in the memory of the field tester upon completion of the test.

B. The test result records saved by the tester shall be transferred into a Windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee shall be made that these results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test.

C. The database for the completed job shall be stored and delivered on CD-ROM. This CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.

D. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:

1. The identification of the link in accordance with the naming convention defined in the overall system documentation.

2. The overall Pass/Fail evaluation of the link-under-test including the Attenuation worst-case margin (margin is defined as the difference between the measured value and the test limit value as defined in this document).

3. The date and time the test results were saved in the memory of the tester.

E. The following general information is to be provided in the electronic database containing the test result information for each link:

1. The identification of the customer site as specified by the end user.

2. The overall Pass/Fail evaluation of the link-under-test.

3. The name of the standard selected to execute the stored test results.

4. The cable type and the value of the ‘index of refraction’ used for length calculations.

5. The date and time the test results were saved in the memory of the tester.

6. The brand name, model, and serial number of the tester.

7. The revision of the tester software and the revision of the test standards database in the tester.

F. The detailed test results data to be provided in the electronic database for each tested optical fiber shall contain the following information:

1. The identification of the link/fiber in accordance with the naming convention defined in the overall system documentation.

2. The insertion loss (attenuation) measured at each wavelength, the test limit calculated for the corresponding wavelength, and the margin (difference between the measured attenuation and the test limit value).

G. The link length shall be reported for each optical fiber for which the test limit was calculated.

H. Contractor shall provide accurate as-built Construction Drawings at the site during construction.

I. The Drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. The Owner will provide floor plans in paper and electronic (“.dwg”, AutoCAD rel. 2004 and “.dxf”) formats on which as-built construction information can be added. These documents will be modified accordingly by the Contractor to denote as-built information as defined above and returned to the Owner.

J. The Contractors shall annotate the base Drawings and return to the Consultant in hard copy (same plot size as originals) and electronic (AutoCAD rel. 2004 and “.dxf”) form.

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Backbone Voice Cabling

A. The voice backbone cable shall link the Main Closet and Telecommunications Rooms serving the building. The cables shall be CMP rated where required.

B. Voice backbone cable shall incorporate 24 AWG solid annealed copper conductors insulated with a polyvinyl chloride skin over expanded polyethylene. Conductors shall be twisted to form pairs and fully color-coded.

C. The voice backbone cable shall be sized as detailed on the Drawings.

D. Conductors shall be identified by the insulation color of each conductor. The color code shall follow the industry standard composed of ten (10) distinctive colors to identify 25 pairs in accordance with ICEA publication S-80-576-1988. Marking of each mate of the primary conductor in a pair with the color of that primary conductor is optional.

E. The voice backbone cable shall meet or exceed the EIA/TIA Category 3 performance requirements.

F. When cables of larger than 25 pairs are required, the core shall be assembled into 25-pair subunits, each color-coded in accordance with ICEA publication S-80-576-1988. Cables with over 600 pairs shall have 25-pair binder groups combined into super units. These super units shall be wrapped with a solid color thread that follows the primary color scheme of white, red, black, yellow, and violet. Binder color code integrity shall be maintained wherever cables are spliced.

G. All cables and equipment shall be furnished, installed, wired, and tested by the Contractor.

H. Manufacturers:

1. Belden
2. Berk-Tek
3. General Cable
4. Superior Essex
5. Or approved equal

2.3 Tight-Buffered Optical Fiber Cables for Indoor Distribution Applications

A. General Considerations

1. The cable shall meet the requirements of the National Electrical Code (NEC) Section 770.
2. For plenum applications, the cable shall meet applicable flame tests: ANSI/UL 910 (NFPA 262-1994).
3. Finished cables shall conform to the applicable performance requirements of Tables 8-6 and 8-7 of the Insulated Cable Consultants Association, Inc. (ICEA) *Standard for Fiber Optic Premises Distribution Cable* (ICEA S-83-596).

B. Cable Construction

1. The coated fiber shall have a layer of Teflon placed between the acrylate coating of the optical fiber and the thermoplastic buffer. The diameter of the thermoplastic buffer coating shall be 900 ±50µm. The fiber coating and buffer shall be removable with commercially available stripping tools in a single pass for connectorization or splicing.

2. Cables with 2 to 24 fibers layered aramid yarns shall serve as the tensile strength member of the cable.

3. A ripcord shall be applied between the aramid yarns and the outer jacket to facilitate jacket removal.

4. The outer jacket shall be extruded over the aramid yarns for physical and environmental protection. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness. The jacket shall be smooth, as is consistent with the best commercial practice.

5. The fibers shall be stranded around a dielectric central member.

6. For cables containing 12-24 fibers, the fibers shall be arranged in two layers.

7. The central member shall be over coated with a thermoplastic, when required, to achieve dimensional sizing to accommodate and support the 900 µm buffered fibers.

8. Cables with 24 to 60 fibers shall have unitized riser and plenum constructions.

9. The buffered fibers shall be grouped in six-fiber subunits.

10. The fibers shall be stranded around a dielectric central member in the subunit.

11. Layered aramid yarns shall serve as the tensile strength member of the subunit.

12. A ripcord may be applied between the aramid yarns and the subunit jacket to facilitate jacket removal.

13. The subunit jacket shall be extruded over the aramid yarns for physical and environmental protection. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness. The jacket shall be smooth, as is consistent with the best commercial practice.

14. The subunits shall be stranded around a dielectric central member. A ripcord shall be inserted beneath the outer jacket to facilitate jacket removal. The outer jacket shall be extruded around the subunits. The strength members shall be of a high modulus aramid yarn. The aramid yarns shall be helically stranded around the buffered fibers. Non-toxic, non-irritant talc shall be applied to the yarns to allow them to be easily separated from the fibers and the subunit jacket.

C. Outer Cable Jacket

1. The jacket shall be continuous, free from pinholes, splits, blisters, or other imperfections. The jacket shall have a consistent, uniform thickness; jackets extruded under high pressure are not acceptable. The jacket shall be smooth, as is consistent with the best commercial practice. The jacket shall provide the cable with a tough, flexible, protective coating, able to withstand stresses. The nominal thickness of the cable outer jacket shall be sufficient to provide adequate cable protection while meeting the mechanical, flammability, and environmental test requirements of this document over the life of the cable.

2. The indoor distribution cable specified herein shall have an interlocking armor made of steel or aluminum. Provide plenum rated cable as required.

3. The indoor distribution cable specified herein shall be non-conductive. Provide plenum rated cable as required.

4. The color of the jacket shall match the jacket color of the optical fiber cable located inside of the cable.

D. Fiber Identification

1. The individual fibers shall be color-coded for identification. The optical fiber color-coding shall be in accordance with ANSITIA/EIA-598-B “Optical Fiber Cable Color Coding.” The coloring material shall be stable over the temperature range of the cable, shall not be susceptible to migration, and shall not affect the transmission characteristics of the optical fibers. Color-coded buffered fibers shall not adhere to one another.

2. When buffered fibers are grouped into individual subunits, each subunit jacket shall be numbered for identification, with the exception of filler subunits where used. The number shall be repeated at regular intervals. The subunit jacket color shall be aqua for subunits containing OM3/4 multimode fibers, yellow for subunits containing singlemode fibers, and white for filler subunits.

3. The outer jacket for all dielectric cable shall be marked with the manufacturer name or UL file number, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket. The cable jacket color shall be Aqua for cables containing OM3/4 multimode fibers and yellow for cables containing singlemode fibers.

4. Cables shall be marked with the manufacturer name, date of manufacture, fiber type, flame rating, listing symbol, and sequential length markings every two feet. The marking shall be in contrasting color to the cable jacket. The cable jacket color shall match the color of the core optical fiber cable.

E. Cable Specifications

1. Temperature Range

   a. Non-Plenum Applications: The storage temperature range for the cable on the original shipping reel shall be -40 to +70ºC. The installation/operating temperature range for riser cables shall be -20 to +70 ºC. Testing shall be in accordance with FOTP-3.

   b. Plenum Applications: The storage temperature range for the cable on the original shipping reel shall be -40 to +70ºC.The installation/operating temperature range for plenum cables shall be 0 to +70ºC.Testing shall be in accordance with FOTP-3.

2. Compressive Load Resistance

   a. When tested in accordance with FOTP-41, Compressive Loading Resistance of Fiber Optic Cables, the cable shall withstand a minimum compressive load of 89 N/cm (50 lbf/in) applied uniformly over the length of the compression plate. While under compressive load, the fiber shall not experience an attenuation change greater than 0.4 dB at 1550 nm (singlemode) or greater than 0.6 dB at 1300 nm (multimode). After the compressive load is removed, the fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

3. Cyclic Flexing

   a. When tested in accordance with FOTP-104, Fiber Optic Cable Cyclic Flexing Test, the cable shall withstand 25 mechanical flexing cycles at a rate of 30 ± 1 cycle per minute. The fiber shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

4. High and Low Temperature Bend

   a. When tested in accordance with FOTP-37, Fiber Optic Cable Bend Test, Low and High Temperature, the cable shall withstand four full turns around a mandrel at test temperatures of 0 ºC and +50 ºC. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.5 dB at 1300 nm (multimode).

5. Impact Resistance

    a. When tested in accordance with FOTP-25, Repeated Impact Testing of Fiber Optic Cables and Cable Assemblies, the cable shall withstand a minimum of 20 impact cycles for riser cables and 10 impact cycles for plenum cables. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or greater than 0.4 dB at 1300 nm (multimode).

6. Temperature Cycling

    a. When tested in accordance with FOTP-3, Procedure to Measure Temperature Cycling Effects on Optical Fiber, Optical Cable, and Other Passive Fiber Optic Components, the change in attenuation at extreme operational temperatures (0 to +50 ºC) shall not exceed 0.3 dB/km at 1550 nm (singlemode) or 0.6 dB/km at 1300 nm (multimode). The change in attenuation is measured with respect to the baseline values measured at room temperature before temperature cycling.

7. Twist-Bend

    a. When tested in accordance with FOTP-91, Fiber Optic Cable Twist-Bend Test, a length of cable no greater than 2 meters shall withstand 10 cycles of mechanical twisting and bending around a mandrel 20 times the cable outer diameter. The fibers shall not experience an attenuation change greater than 0.2 dB at 1550 nm (singlemode) or 0.4 dB at 1300 nm (multimode).

F. Multimode OM4 (50/125 µm)

1. The multimode fiber utilized in the optical fiber cable shall meet EIA/TIA-492AAAA-A-1997, Detail Specification for 50µm Core Diameter/125µm Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers, unless noted otherwise. Cable shall have the following specifications:

    a. Core Diameter: 50 ± 3 µm

    b. Core Non-Circularity: ≤5%

    c. Cladding Diameter: 125± 2 µm

    d. Cladding Non-Circularity: <2.0%

    e. Core-to-Cladding Concentricity: ≤ 3 µm

    f. Coating Diameter: 245 ± 2 mm

    g. Refractive Index Profile: Graded index

    h. Numerical Aperture: 0.275 ± 0.015

    i. Maximum Attenuation: less than 3.0 dB/km at 850 nm and 1.0 dB/km at 1300 nm.

2. IEEE 802.3ae Performance: The fiber shall support laser-based 10 Gigabit Ethernet (10GbE) operation for up to 550 meters.

3. Attenuation at the Water Peak: The attenuation coefficient at 1380 nm shall not exceed the attenuation coefficient at 1300 nm by more than 1.0 dB/km.

4. Macrobend Attenuation: The attenuation due to 100 turns of fiber around a 75-± 2 mm diameter mandrel shall not exceed 0.5 dB at 850 nm or 1300 nm.

G. Singlemode OS2

1. The singlemode fiber utilized in the optical fiber cable shall meet EIA/TIA-492CAAA, Detail Specification for Class IVa Dispersion-Unshifted Singlemode Optical Fibers, and ITU recommendation G.652, Characteristics of Singlemode Optical Fiber Cable. The cable shall meet the following specifications:

a. Core Diameter (Characterized): 8.3 µm

b. Cladding Diameter: 125. ±1.0µm

c. Core-to-Cladding Concentricity: ≤ 0.8 µm

d. Cladding Non-Circularity: ≤1.0 %

e. Coating Diameter: 245 ±10µm

2. Attenuation: The maximum attenuation shall be 0.5 dB/km at 1310 nm and 0.4 dB/km at 1550 nm.

3. Attenuation Uniformity: There shall be no point discontinuity greater than 0.10 dB at either 1310 nm or 1550 nm.

4. Attenuation at the Water Peak: The attenuation at 1383 ± 3 nm shall not exceed 2.1dB/km.

5. Cutoff Wavelength: The cabled fiber cutoff wavelength shall be ≤1260 nm.

6. IEEE 802.3z Performance: The fiber shall support laser-based Gigabit Ethernet (1GbE) operation in the 1000BASE-LX (1310 nm) operating window at 10000 m.

7. IEEE 802.3ae Performance: The fiber shall support laser-based Gigabit Ethernet (10GbE) operation in the 10000BASE-LX (1310 nm) operating window at 10000 m.

8. IEEE 802.3ba Performance: The fiber shall support laser-based Gigabit Ethernet (40/100GbE) operation in the 40000/100000BASE-LX (1310 nm) operating window at 10000 m.

9. Mode Field Diameter: The mode field diameter of the fiber shall be 9.30 ±0.50µm at 1310 nm 10.50 ±1.0µm at 1550 nm.

10. 12 Macrobend Attenuation: The attenuation due to 100 turns of fiber around a 75-± 2mm diameter mandrel shall not exceed 0.05 dB at 1310 nm and 0.10 dB at 1550 nm.

11. Zero Dispersion Wavelength (∂o): The zero dispersion wavelength of the fiber shall be 1301.5 nm ≤ ∂o ≤ 1321.5 nm.

12. Zero Dispersion Slope (So): The zero dispersion slope of the fiber shall be ≤0.092 ps/(nm•km).

13. Maximum Dispersion: The maximum dispersion shall be ≤ 3.2 ps/(nm•km) from 1285 nm through 1330 nm and shall be ≤18 ps/(nm•km) at 1550 nm.

H. The cable shall be manufactured by:

1. Leviton

2. Belden

3. Berk-Tek

4. Corning

5. General Cable

6. Or approved equal.

2.4 Loose Tube Optical Fiber Cables for Outside Plant Distribution Applications

A. The cable shall be all-dielectric gel-free designed for outdoor and limited indoor use for campus backbones in lashed aerial and duct installations.

B. The cable shall be fully waterblocked using water-swellable materials.

C. The outer sheath shall be marked with the manufacturer's name, words identifying the cable type (e.g. "Optical Cable" or "Fiber Optic Cable"), year of manufacture, and sequential length markings. The actual length of the cable shall be within -0/+1% of the length markings. The marking shall be in a contrasting color to the cable jacket.

D. Temperature Range:

1. Storage: -40 to +70C (no irreversible change in attenuation)
2. Operating: -40 to +70C
3. Humidity Range: 0 to 100%

E. F. Maximum Tensile Strength:

1. During Installation: 2700 Newton (600 lb. force) (no irreversible change in attenuation)
2. Long Term: 890 N (200 lb. force)

F. G. Bending Radius:

1. During Installation: 20 times cable diameter
2. No Load: 10 times cable diameter

G. The maximum pulling tension shall be 2700 N (608 lbf) during installation (short term) and 890 N (200 lbf) long term installed.

H. The cable shall be manufactured by:

1. Leviton
2. Belden
3. Corning
4. General Cable
5. Draka
6. Or approved equal

I. Single Mode Optical Fiber Performance

1. The single mode fiber shall be dispersion-unshifted, fiber which meets the ITU-T G.652c requirements.
2. The fiber cable shall be fully capable of handling existing and legacy singlemode applications which traditionally operate in the 1310nm and 1550nm regions.
3. The fiber cable shall be designed to handle applications that utilize the "Extended" E band, 1360-nm to 1460 nm.
4. The fiber cable shall also be designed to provide optimum performance from 1265nm to 1625nm making it suitable for 16-channel Course Wavelength Division Multiplexing applications.
5. The fiber shall meet the following specifications:
    a. Fiber Type Single mode; doped silica core surrounded by a concentric glass cladding.
    b. Core Diameter: 8-9 µm. All fibers shall be of the same nominal core diameter and profile.
    c. Cladding Diameter: 125 + 0.7 micron
    d. Core-to-Cladding Offset: < 0.5 micron

e. Cladding Non-Circularity: < 1.0%

f. Coating Diameter: 245 + 10 micron

g. The coating shall be mechanically strippable without damaging the optical fiber.

h. Cutoff Wavelength (cabled fiber; ccf)<1260-nm

i. Mode field diameter: 9.2+0.4 micron at 1300-nm; 10.4+0.5 micron at 1550 -nm

j. Zero Dispersion Wavelength: 1302< < 1322nm

k. Zero Dispersion Slope (S0): <0.092 ps/nm2*km

l. Fiber Attenuation:

i. 1383-nm 0.4 dB/km

ii. 1550-nm 0.3 dB/km

iii. The average change in attenuation at extreme operational temperature (40 C to +70 C) shall not exceed 0.05 dB/km at 1550 nm. The magnitude of the maximum attenuation change of each individual fiber shall not be greater than 0.05 dB/km at 1550 nm.

m. Fiber Dispersion (maximum):

i. 1285-1330-nm < 3.2-ps/nm*km

ii. 1625-nm < 22-ps/nm*km

n. 14. No single mode optical fiber shall show a point discontinuity greater than 0.03 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that fiber by the Owner.

2.5 Fiber Optic Connectors

A. The MM optical connector shall be LC UPC type.

B. The SM optical connector shall be LC UPC type.

C. The OSP MM optical connector shall be SC UPC type.

D. The OSP SM optical connector shall be SC UPC type.

E. The connector ferrule shall be ceramic or glass-in-ceramic. The optical fiber within the connector ferrule shall be secured with an adhesive.

F. The attenuation per mated pair shall not exceed 0.35 dB (individual) and 0.2 dB (average). Connectors shall sustain a minimum of 200 mating cycles per EIA/TIA-455-21 without violating specifications.

G. The connector shall meet the following performance criteria:

1.	Cable Retention (FOTP-6)	0.2 dB
2.	Durability (FOTP-21)	0.2 dB
3.	Impact (FOTP-2)	0.2 dB
4.	Thermal Shock (FOTP-3)	0.2 dB
5.	Humidity (FOTP-5)	0.2 dB

H. Connectors shall be field terminated and polished or fusion spliced. Mechanical, quick connect or index-gel based connectors are not allowed.

PART 3 - EXECUTION

3.1 Testing

A. Refer to Section 27 00 00 for additional requirements.

B. Field Test Requirements for Fiber Optic Cabling System

1. The fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, the Contractor shall provide cable manufacturer's test report for each reel of cable provided. These test reports shall include the manufacturers on reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.

2. Factory data shall be provided upon request, showing on-the-reel bandwidth performance results as tested at the factory.

3. Every fiber optic backbone link in the installation shall be tested in accordance with the field test specifications defined by the Telecommunications Industry Association (TIA) standard ANSI/TIA/EIA-568-C or by the appropriate network application standard(s), whichever is more demanding.

4. The test shall include the representative connector performance at the connecting hardware associated with the mating of patch cords. The test does not, however, include the performance of the connector at the interface with the test equipment.

5. 100% of the installed cabling links shall be tested and shall pass the requirements of the standards mentioned above and as further detailed in this document. Any failing link shall be diagnosed and corrected at no additional cost to the Owner. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for all links shall be provided in the test results documentation in accordance with RFP.

6. Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests. These certificates may have been issued by any of the following organizations or an equivalent organization:

   a. The manufacturer of the fiber optic cable and/or the fiber optic connectors

   b. The manufacturer of the test equipment used for the field certification

   c. Training organizations authorized by BICSI

7. Field test instruments for multimode fiber cabling shall meet the requirements of ANSI/TIA/EIA-526-14-A. The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause 11 of ANSI/TIA/EIA-568-C.1) with a Category 1 light source.

8. Field test instruments for singlemode fiber cabling shall meet the requirements of ANSI/EIA/TIA-526-7.

9. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.

10. The fiber optic launch cables and adapters shall be of high quality and the cables shall not show excessive wear resulting from repetitive coiling and storing of the tester interface adapters.

11. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests.

12. Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.

13. A representative of the Owner shall be invited to witness field testing. The representative shall be notified of the start date of the testing phase five business days before testing begins.

14. A representative of the Owner will select a random sample of 5% of the installed links. The results obtained shall be compared to the data provided by the installation Contractor. If more than 2% of the sample results differ in terms of the Pass/Fail determination, the installation Contractor, under supervision of the Owner representative, shall repeat 100% of the testing. The cost of retesting shall be borne by the installation Contractor.

C. Fiber Performance Test Parameters

1. The link attenuation shall be calculated by the following formulas specified in ANSI/TIA/EIA standard 568-B.

   a. Link Attenuation = Cable_Attn + Connector_Attn + Splice_Attn

   b. Cable_Attn (dB) = Attenuation_Coefficient (dB/km) * Length (Km)

   c. The values for the Attenuation_Coefficient are listed in the table below:

Type of Optical Fiber	Wavelength (nm)	Attenuation_Coefficient (dB/km)
Multimode 62.5/125 µm	850	3.5
	1300	1.5
Multimode OM3 50/125 µm	850	3.5
	1300	1.5
Multimode OM4 50/125 µm	850	3.0
	1300	1.5
Singlemode (Inside plant)	1310	0.5
	1550	0.4
Singlemode (Outside plant)	1310	0.4
	1550	0.5

   d. Connector_Attn (dB) = number_of_connector_pairs * connector_loss (dB)

   e. Maximum allowable mated connectors_loss = 0.50 dB

   f. Splice_Attn (dB) = number of splices (S) * splice_loss (dB)

   g. Maximum allowable splice_loss = 0.1 dB (when tested bidirectionally)

2. Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices—i.e., it does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.

3. Test equipment that measures the link length and automatically calculates the link loss based on the above formulas is preferred.

4. The above link test limits attenuation are based on the use of the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1. The user shall follow the procedures established by these standards or application notes to accurately conduct performance testing.

5. The backbone link (multimode/singlemode) shall be tested in two directions at both operating wavelengths to account for attenuation deltas associated with wavelength.

6. Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A.

7. Because backbone length and the potential number of splices vary depending upon site conditions, the link attenuation equation shall be used to determine limit (acceptance) values.

8. Multimode backbone links are designed to be used with network applications that use laser light sources (underfilled launch conditions). However, the link attenuation equation has been based upon the use of a light source categorized as Category 1, Overfilled.

9. Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1. All singlemode links shall be certified with test tools using laser light sources at 1310 nm and 1550 nm.

3.2 Training

A. Refer to Section 27 00 00 for additional requirements.

3.3 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.4 Fiber Optic Cable Installation Requirements

A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.

B. A minimum of 15 feet of slack cable (each cable) shall be coiled and secured at each end.

End of Section

27 15 00 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 Scope

A. This section describes the products and execution requirements relating to telecommunications voice, data and video horizontal (station) cabling and termination components.

B. Horizontal cabling is the cabling between the work area telecommunications outlet and the telecommunications room (TR). Horizontal cabling is often referred to as “station cabling”.

C. The horizontal cabling system will consist of the following:

1. Unshielded Twisted Pair (UTP) Cable
2. Outlet Termination Modules (jacks)
3. Outlet Termination Plates
4. Horizontal Fiber Optic/Copper Composite Cabling
5. Above Ceiling Cable Support Systems
6. Horizontal Cable Testing Requirements
7. Cable Pathway/Sleeve Requirements

1.2 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 23 – Pathways for Technology Systems

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 11 00 – Communications Equipment Rooms

F. Section 27 13 00 – Communications Backbone Cabling

G. Section 27 16 00 – Communications Connecting Cords

H. Section 27 18 00 – Communications Labeling and Identification

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

1.3 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Category 6 Horizontal Copper Cables

A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.

C. This specification defines the requirements for commercially available high performance Category 6 cable.

D. This cable shall be suitable for installation free-air, in building risers, in conduit, and/or in cable tray and shall carry CMP rating.

E. The cable design described herein shall exceed transmission performance of Category 6 cables.

F. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

G. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

H. The jacket color for data cables shall be BLUE.

I. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.

J. Manufacturers:

1. Berk-Tek Lanmark 1000

2. General Cable Genspeed 6000

3. Commscope Uniprise Ultramedia 6

2.3 Category 6a Horizontal Copper Cables

A. All cables and equipment shall be furnished, tested, installed and wired by the Contractor.

B. All horizontal data cables shall terminate on modular patch panels in the telecommunications closet as specified on the Drawings.

C. All wireless access points shall utilize Category 6a cable unless noted otherwise.

D. This cable shall be suitable for installation free-air, in building risers, in conduit, and/or in cable tray and shall carry CMP rating.

E. The cable design described herein shall exceed transmission performance of Category 6a cables.

F. Category 6a cables shall be bundled separately from lower Category rated cabling.

G. Cables shall be Underwriters Laboratory (UL) listed, comply with Article 800 (Communications Circuits) of the National Electrical Code, and meet the specifications of NEMA (low loss), UL 444, and ICEA. Conductor shall also conform to the requirements for solid annealed copper wire in accordance with ASTM B 3.

H. All cables, termination components, and support hardware shall be furnished, tested, installed, and wired by the Contractor.

I. The jacket color for data cables shall be BLUE.

J. IMPORTANT: Cable and termination components (jack, patch panel, wiring blocks) are specified to function as a system. The compatibility of the cable to be installed with the proposed termination components shall be recognized and documented by the termination component manufacturer.

K. Manufacturers:

1. Berk-Tek LANmark-XTP
2. General Cable
3. Commscope Uniprise

2.4 Information Outlet

A. General

1. Station cables shall each be terminated at their designated workstation location in the connector types described in the subsections below. Included are modular jacks, faceplates, and surface mount raceway. The combined assembly is referred to as the Standard Information Outlet (SIO). These connector assemblies shall snap into a mounting frame.

2. SIOs shall be mounted in new outlet boxes, where existing boxes are in place, on surface mount raceway typically in surface raceway with barrier, in floor mount interface boxes, or on power poles either currently owned or new.

3. The telecommunications outlet frame shall accommodate or incorporate the following:

   a. A minimum of four (4) modular jacks, when installed on a wall-mounted assembly.

   b. A mechanism for adjusting the surface plate to a plumb position.

4. When multiple jacks are identified in close proximity on the Drawings. The Contractor shall determine the optimum compliant configuration based on the products proposed.

5. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each SIO type for review by the Consultant.

B. Modular Jack

1. Data jacks shall be non-keyed 8-pin modular jacks.
2. Termination components shall be designed to maintain the cable's pair twists as closely as possible to the point of mechanical termination.
3. Jacks shall utilize a four-layer printed circuit board to control NEXT.
4. Jack housings shall fully encase and protect printed circuit boards and IDC fields.
5. Modular jack contacts shall accept 2500 plug insertions.
6. Modular jack contacts shall be formed flat for increased surface contact with mated plugs. These contacts shall be arranged on the PC board in two staggered arrays of four to maximize contact spacing and minimize crosstalk.
7. Modular jack contacts shall be constructed of Beryllium copper for maximum spring force and resilience.
8. Contact Plating shall be a minimum of 50 micro inches of gold in the contact area over 50 micro-inch of nickel, compliant with FCC part 68.5.
9. Jack termination shall be 110 IDC, integral to the jack housing, laid out in two arrays of four contacts.
10. Jacks shall utilize a paired punch down sequence. Cable pairs shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
11. Jacks shall utilize tin lead plated (60% tin/40%lead) phosphor bronze 110 insulation displacement contacts.
12. Jacks shall terminate 22-26 AWG stranded or solid conductors.
13. Jacks shall terminate insulated conductors with outside diameters up to .050".
14. Jacks shall be compatible with single conductor 110 impact termination tools.
15. Jacks shall be compatible with EIA/TIA 606 color code labeling and accept snap on icons for identification or designation of applications.
16. Jacks shall be BLUE in color.
17. Jacks shall be marked as either T568A or T568B wiring.
18. Category 6 & 6a jacks shall be manufactured by:
    a. Leviton
    b. Panduit
    c. Uniprise

C. Outlet Faceplates

1. Faceplates shall match the electrical outlets for material type and color.
2. Faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.
3. Any unused jack positions shall be fitted with a removable blank inserted into the opening.
4. Modular jacks shall have capability to incorporate a dust cover that fits over and/or into the jack opening. The dust cover shall be designed to remain with the jack assembly when the jack is in

use. No damage to the jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the jack pinning shall not be accepted.

5. Wall-mounted “voice only” outlets shall be installed where identified on the floor plan Drawings to accommodate wall-mounted telephone sets. The wall plate shall be of stainless steel construction, accommodate one RJ-45 jack, mount on a standard single gang outlet box or bracket, and include mating lugs for wall phone mounting.

6. All standard information outlets and the associated jacks shall be of the same manufacturer throughout each/the building. An allowable exception, however, is the wall-mounted “voice only” outlet described above.

7. Faceplates shall be manufactured by modular jack manufacturer.

D. Surface Mount Interface Box

1. Low profile, surface mount boxes shall incorporate recessed designation strips at the top for identifying labels. Designation strips shall be fitted with clear plastic covers.

2. The box shall feature built-in cable management for both fiber and copper applications.

3. Any unused jack positions shall be fitted with a removable blank inserted into the opening.

4. Modular jacks shall have capability to incorporate spring-loaded shutter door for added protection from dust and other airborne contaminants. The dust cover shall be designed to remain with the jack assembly when the jack is in use.

5. The box shall have the capability to incorporate optional magnets that can be internally mounted.

6. Surface mount box shall be manufactured by modular jack manufacturer.

2.5 Horizontal Composite MM Fiber Optic/Copper Cabling for Extended Ethernet with PoE

A. For devices that are beyond the distance limitation of UTP cabling and require PoE to operate such as IP surveillance cameras and wireless access points the Contractor, as noted on the drawings, shall provide a composite 2-strand OM3 MM fiber optic cable with an 18 awg 2-conductor stranded copper cable for power within a single jacket. The Contractor shall provide 12 awg when required based on distances and voltage drop.

B. Provide SC, ST or LC connectors has required for the application and devices the fiber will be connecting to.

C. All pre-terminated and field terminated fiber shall be tested and certified with an OTDR and meet OM3 standards.

D. Provide plenum, riser or OSP rated cable as required for the application.

E. Manufacturer:

1. Berk-Tek OneReach

2. CommScope Powered Fiber

3. Or approved equal

2.6 Additional Modules for Copper Cabling

A. Additional modules for copper shall include the following:

1. 50 and 75 Ohm BNC coax coupler modules, male-male

2. F-type coax coupler module, male-male threaded

3. RCA connector modules with black, red, yellow, and white inserts
4. Solder, pass-through and punch-down termination types
5. Video connector modules - coupler and punch-down termination types
6. Blank module to reserve space for future additions

B. The connectors shall be designed to allow snap-in installation into the outlet faceplates.

PART 3 - EXECUTION

3.1 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.2 Twisted Pair Test Equipment

A. Test equipment used under this contract shall be from a manufacturer who has a minimum of five years' experience in producing field test equipment. Manufacturers shall be ISO 9001 certified.

B. All test tools of a given type shall be from the same manufacturer and have compatible electronic results output. Test adapter cable shall be approved by the manufacturer of the test equipment. Baseline accuracy of the test equipment shall exceed TIA Level III, as indicated by independent laboratory testing.

C. Test equipment shall:

1. Be capable of certifying Category 5E, 6 and 6A permanent links.
2. Have a dynamic range of at least 100dB to minimized measurement uncertainty.
3. Be capable of storing full frequency sweep data for all tests and printing color graphical reports for all swept measurements.
4. Include S-band time domain diagnostics for NEXT and return loss.
5. Be capable of running individual NEXT, return loss, etc., measurements in addition to AutoText.
6. Include a library of cable types, stored by major manufacturer.
7. Store at least 1000 Category 5e, 6 or 6A autotests in internal memory.

D. The measurement reference plane of the test equipment shall start immediately at the output of the test equipment interface connector. There shall not be a time domain dead zone of any distance that excludes any part of the link from the measurements.

E. The approved manufacturer of the test equipment is Fluke and JDSU/Viavi.

3.3 Training

A. Refer to Section 27 00 00 for additional requirements.

3.4 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.5 Station Cabling

A. Information outlet cables with copper media (voice & data UTP and "TV" coax) shall be located as detailed on the Project Drawings.

B. The Contractor shall utilize these documents in determining materials quantities and routing.

C. Station cables shall be run to the information outlet from the telecommunications room serving each area in conduit, free-air above drop ceiling, in cable tray, and/or in modular furniture.

D. The maximum station cable drop length for UTP cables shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and shall include any slack required for the installation and termination. The Contractor shall install station cabling in a fashion to avoid unnecessarily long runs.

E. Contractor shall verify cable lengths comply with published standards; prior to installation of any horizontal cabling, this Contractor shall verify cable paths and confirm no horizontal cable will exceed 295 total feet. If it is determined that the cable will exceed 295', this Contractor shall route the cabling to another telecommunications room or determine shorter path so cables are under 295'. If this is not possible, the Contractor shall notify the Consultant prior to installation. Failure to do this step will not result in a change order from the Contractor.

F. All cables shall be installed splice-free unless otherwise specified.

G. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.

H. Avoid abrasion and other damage to cables during installation.

I. All cable shall be free of tension at both ends. In cases where the cable shall bear some stress, Kellom grips may be used to spread the strain over a longer length of cable.

J. Where installed free-air, installation shall consider the following:

1. Cable shall run at right angles and be kept clear of other trades' work.

2. Cables shall be supported according to code, using "J-hooks" anchored to ceiling concrete, walls, piping supports, or structural steel beams.

3. Hooks shall be designed to maintain cable bend to larger than the minimum bend radius (typically 4x the cable diameter).

4. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If cable "sag" at mid-span exceeds 6 inches, another support shall be used.

K. Cable shall never be laid directly on the ceiling grid.

L. Cables shall not be attached to existing cabling, plumbing, or steam piping, ductwork, ceiling supports, or electrical or communications conduit.

M. Manufacturers' minimum bend radius specifications shall be observed in all instances. Use of plastic cable ties is not acceptable. Cable bundles shall be neatly dressed with use of Velcro type straps.

N. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

O. A coil of one foot in each cable shall be placed in the ceiling at the last support (e.g., J-hook) before the cables enter a fishable wall, conduit, surface raceway, or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15 feet of slack shall be left in each station cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

P. To reduce or eliminate EMI, the following minimum separation distances from ≤480V power lines shall be adhered to:

1. Twelve (12) inches from power lines of <5-kVa
2. Eighteen (18) inches from high voltage lighting (including fluorescent)
3. Thirty-nine (39) inches from power lines of 5-kVa or greater
4. Thirty-nine (39) inches from transformers and motors

Q. All openings shall be sleeved and firestopped per prevailing code requirements upon completion of cable installation.

3.6 Information Outlet

A. Information outlets shall be flush mounted on wall-mounted boxes, in floor-mounted boxes, on surface raceway, or on modular furniture.

B. Any outlets to be added where these conditions are not met shall be positioned at a height matching that of existing services or as directed otherwise by the Site Coordinator and the Consultant. Nominal height (from finished floor to center line of outlet) in new installation shall be as follows:

1. Standard Voice & Data Outlet (SIO) shall match adjacent electrical outlets.
2. Wall-Mounted Telephone Outlet (Standard Voice only) shall meet ADA requirements for both front and side reach access.

C. The Contractor shall coordinate the style of the telecommunication outlets to be installed in the floor mount boxes and surface mount raceways with the Owner.

3.7 Elevator Interface

A. The Contractor shall furnish and install an elevator interface box outside of the elevator equipment room.

1. The Contractor shall provide an elevator telecommunications junction box located outside of the Elevator Machine Room, for interface of telecommunication cable to the elevator cab(s). This requirement complies with ANSI A17.1 code which prevents work within the Elevator Machine Room, other than specific elevator work.
2. Telecommunications J-box shall include a keyed lockable door. Additionally, the J-box shall have proper punch down blocks and data jacks suitable for terminating all cables within the J-box.
3. The Contractor shall provide any voice/data cables to this enclosure as required.
4. Electronics or cable for other systems such as security shall not be placed within this enclosure.
5. Coordinate exact location of elevator security junction box with the Elevator Contractor, Architect, and Consultant, prior to installation.
6. Cables entering the elevator telecommunications J-box and elevator equipment room shall be appropriately labeled by the Contractor, so that the Elevator Contractor can connect the appropriate wires to the elevator controllers. Wires should be individually labeled to separate them from other elevator functions and to assist the Elevator Contractor in making proper connection points.

3.8 Cable Termination

A. At the telecommunication closet, all data and voice cables shall be positioned on termination hardware in sequence of the outlet ID, starting with the lowest number.

B. Termination hardware (blocks and patch panels) positioning and layout will be reviewed and approved by the Consultant prior to construction. The review does not exempt the Contractor from meeting any of the requirements stated in this document.

C. Cable Termination – Data/Voice UTP

1. Data/voice patch panels shall be designed and installed in a fashion as to allow future station cabling to be terminated on the panel without disruption to existing connections.

2. Data patch panels shall be sized to accommodate a minimum of 20% growth in the quantity of stations relative to the initial installation.

3. At information outlets and data/voice patch panels, the installer shall ensure that the twists in each cable pair are preserved to within 0.5 inch of the termination for data/voice cables. The cable jacket shall be removed only to the extent required to make the termination.

D. Cable Termination – Fiber Optic

1. All fibers shall be terminated using the specified connector type.

2. All terminated fibers at the telecommunications closets shall be mated to couplings mounted on patch panels. Couplings shall be mounted on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.

3. All couplings shall be fitted with a dust cap.

4. Fibers from multiple locations may share a common enclosure, but they shall be segregated on the connector panels and clearly identified. Fibers from multiple destinations may be secured in a common enclosure, provided they are clearly identified as such. Fibers from different locations shall not share a common connector panel (e.g., “insert”).

5. Slack in each fiber shall be provided as to allow for future re-termination in the event of connector or fiber end-face damage. Adequate slack shall be retained to allow termination at a 30” high workbench positioned adjacent to the termination enclosure(s). A minimum of one meter (~39”) of slack shall be retained regardless of panel position relative to the potential work area.

6. If the cable is armored the Contractor shall install a plastic twist-on bushing on each end of interlocking armored fiber to protect cable from sharp edges of the armor.

3.9 Test Data – Copper Media

A. The test result records saved by the tester shall be transferred into a Windows-based database utility that allows for the maintenance, inspection, and archiving of these test records. A guarantee shall be made that these results are transferred to the PC unaltered, i.e., “as saved in the tester” at the end of each test. Comma separated value (CSV) format is not acceptable.

B. The database for the completed job – including twisted-pair copper cabling links, if applicable –shall be stored and delivered on CD-ROM. This CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.

C. A paper copy of the test results shall be provided that lists all the links that have been tested with the following summary information:

1. The identification of the link in accordance with the naming convention defined in the overall system documentation.

2. The overall Pass/Fail evaluation of the copper channel-under-test, including the NEXT worst-case margin (margin is defined as the difference between the measured value and the test limit value).

3. The overall Pass/Fail evaluation of the fiber link-under-test, including the Attenuation worst-case margin (margin is defined as the difference between the measured value and the test limit value).

4. The date and time the test results were saved in the memory of the tester.

3.10 Copper Station Cables

A. Station cabling testing shall be from the jack at the outlet in the work area to the patch panel on which the cables are terminated.

B. Testing shall be of the permanent link. Contractor shall warrant performance, however, based on channel performance and provide patch cords that meet channel performance criteria. All cabling not tested strictly in accordance with these procedures shall be retested at no cost to the Owner.

C. Testing shall be from the jack at the SIO to the patch panel on which the cables are terminated at the wiring hub.

D. Horizontal “station” cables shall be free of shorts within the pairs and shall be verified for continuity, pair validity and polarity, and wire map (conductor position on the modular jack). Any defective, split, or mispositioned pairs shall be identified and corrected.

E. Testing of the cabling systems rated at TIA Category 5e/6/6a and above shall be performed to confirm proper functioning and performance.

F. Testing of the transmission performance of station cables (Category 5e/6/6a) shall include the following:

1. Length
2. Attenuation
3. Pair to Pair NEXT
4. ACR
5. PSNEXT Loss
6. Return Loss
7. Pair to Pair ELFEXT Loss or ACRF
8. PSEFEXT Loss or PS-ACRF
9. Propagation Delay
10. Delay Skew
11. Return Loss

G. The maximum length of station cable shall not exceed 90 meters, which allows 10 meters for equipment and patch cables.

H. Worst case performance at 20°C, based on a horizontal cable length of 90 meters and equipment cord length of 4 meters, shall be as follows:

1. CATEGORY 6a (Permanent LINK)

Frequency (MHz)	Insertion Loss (Maximum dB)	NEXT Loss Pair to Pair (dB)	PS-NEXT Loss (dB; Worst Case)	ACRF Pair to Pair (dB)	PS-ACRF (dB)
1.0	1.9	65.0	62.0	64.2	61.2
4.0	3.5	64.1	61.8	52.1	49.1
8.0	5.0	59.4	57.0	46.1	43.1
10.0	5.5	57.8	55.5	44.2	41.2
16.0	7.0	54.6	52.2	40.1	37.1
20.0	7.8	53.1	50.7	38.2	35.2
25.0	8.8	51.5	49.1	36.2	33.2
31.25	9.8	50.0	47.5	34.3	31.3
62.5	14.1	45.1	42.7	28.3	25.3
100.0	18.0	41.8	39.3	24.2	21.2
200.0	26.1	36.9	34.3	18.2	15.2
250.0	29.5	35.3	32.7	16.2	13.2
300.0	32.7	34.0	31.4	14.6	11.6
400.0	38.5	29.9	27.1	12.1	9.1
500.0	43.8	26.7	23.8	10.2	7.2

I. In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation method. The Contractor shall make additional tests as the Consultant deems necessary at no additional expense to the Owner or Consultant.

J. All data shall indicate the worst-case result, the frequency at which it occurs, the limit at that point, and the margin. These tests shall be performed in a swept frequency manner from 1 MHz to highest relevant frequency, using a swept frequency interval that is consistent with TIA and ISO requirements. Information shall be provided for all pairs or pair combination and in both directions when required by the appropriate standards.

K. Cables shall be tested to the maximum frequency defined by the standards covering that performance category. Transmission Performance Testing shall be performed using a test instrument designed for testing to the specified frequencies. Test records shall verify “PASS” on each cable and display the specified parameters—comparing test values with standards-based “templates” integral to the unit.

End of Section

27 16 00 – COMMUNICATIONS CONNECTING CORDS

PART 1 - GENERAL

1.1 Scope

A. This section describes the products relating to high quality Category 6 voice and data patch cords.

B. In this section the term patch cords refers to the cords that connect Owner provided data network electronics to the horizontal cable infrastructure.

C. It is important that the horizontal cable system and the provided patch cords work as one complete system for guaranteed channel performance. Patch cords shall be manufactured by the same manufacturer as the jack and patch panels.

D. The Contractor shall provide and deliver all cords as listed in this section. The Owner will be responsible for installation of cords.

1.2 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 23 – Pathways for Technology Systems

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 11 00 – Communications Equipment Rooms

F. Section 27 13 00 – Communications Backbone Cabling

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 18 00 – Communications Labeling and Identification

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

1.3 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Category 6 & 6a Patch Cords

A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.

B. All patch cords shall be round and consist of eight insulated 23 AWG (24 AWG for Cat 5e), stranded copper conductors, arranged in four color-coded twisted pairs within a flame retardant jacket and be backwards compatible with lower performing categories. Modular patch cords shall utilize ISO termination method that is designed to reduce and control near-end cross talk (NEXT) and far end cross talk (FEXT) without compromising signal impedance.

C. Both ends of the cord shall be equipped with modular 8-position (RJ45 style) plugs wired straight through with standards compliant wiring. All modular plugs shall exceed FCC CFR 47 part 68 subpart F and IEC 603.7 specifications, and have 50 micro inches of gold plating over nickel contacts. Cable shall be label-verifiable. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level. Patch cords shall have color-coded insert molded strain relief boot with a latch guard to protect against snagging. Additional color-coding shall be available by the use of snap-in icons.

D. Patch cords shall be wired straight through. Pin numbers shall be identical at each end and shall be paired to match T568B patch panel jack wiring per ANSI/TIA/EIA-568-B. Patch cords shall be unkeyed.

E. The manufacturer of the cords shall be the same as the manufacturer for UTP termination hardware (jacks & patch panels). Cords shall be highest quality patch cords available by connectivity manufacturer.

F. The patch cords shall match the Category rating of the jack and cable it will be connecting to.

G. This Contractor shall provide two (2) Category 6/6A patch cords for each horizontal cable installed. Quantities shall be as follows:

1. Contractor shall confirm patch cord and jack colors with Owner and Consultant prior to ordering.

2. The patch cord category shall match the horizontal channel. I.e. where Cat 6 horizontal cable is installed, provide Cat 6 patch cords. Where Cat 6A horizontal cable is installed, provide Cat 6A patch cords.

3. At the outlet side of the horizontal channel, all patch cords shall be 10’ in length.

4. At the MDF/IDF side of the horizontal channel, patch cords shall be 1’ in length.

5. Provide an additional 20% for future use to be turned over to the Owner.

2.3 Fiber Optic Patch Cords

A. The Owner has the right to determine the final length of the patch cords after the contract is awarded.

B. All MM fiber optic patch cords shall:

1. Be duplex 2-3mm tight buffer design with Aqua jacket.

2. Have LC-LC connectors with straight thru connectors (A-A Polarity).

3. Have 50-micron OM3 core.

C. All SM fiber optic patch cords shall:

1. Be duplex 2-3mm tight buffer design with Yellow jacket.
2. Have LC-LC connectors with straight thru connectors (A-A Polarity).
3. Have 8-9-micron OS2 core.

D. This Contractor shall provide the following patch cords (for pricing purposes only; see section 3.04 below):

Qty	Length	Notes
TBD	3 meter	MM Non-Plenum
TBD	3 meter	SM Non-Plenum

PART 3 - EXECUTION

3.1 Ordering and Delivery

A. Prior to ordering patch cords the Contractor shall schedule meeting with Owner and Consultant to verify patch cord lengths, colors and quantities.

B. Contractor shall coordinate delivery of patch cords with Owner. Contractor shall have list of delivered cords and shall have Owner sign delivery sheet at time of delivery.

End of Section

27 18 00 – COMMUNICATIONS LABELING AND IDENTIFICATION

PART 1 - GENERAL

1.1 Scope

A. This section describes the products and execution requirements relating to labeling of telecommunications cabling, termination components, and related subsystems. Covered systems include the following:

1. Equipment room backboards and equipment racks
2. Station cable and terminating equipment
3. Telecommunications grounds and related components

1.2 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 23 – Pathways for Technology Systems

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 11 00 – Communications Equipment Rooms

F. Section 27 13 00 – Communications Backbone Cabling

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 16 00 – Communications Connecting Cords

I. Section 27 40 00 – AV/Multimedia General Requirements

J. Section 27 41 00 – Audio Visual Systems

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 62 00 – Electronic Access Control System

N. Section 27 64 00 – Video Surveillance System

1.3 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.
2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.
3. Execution: Coordination, testing, training, warranty, and cable management.

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Labels

A. All labels shall be permanent and be machine generated (e.g., Brady or Panduit). No handwritten or non-permanent labels shall be allowed. Labels shall be Brady “I.D. Pro” or XC-Plus or equivalent. Labeling on backboards and/or equipment racks may be pre-cut adhesive type.

B. Characters on all labels shall be black printed on a white background.

C. Label size shall be appropriate to the cable size(s), outlet faceplate layout, patch panel design, or other related equipment sizes and layouts.

D. All labels to be used on cables shall be self-laminating, white/transparent vinyl, and be wrapped around the cable sheath. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminated over the full extent of the printed area of the label.

E. Labels used to identify innerduct carrying fiber optic cable shall be labeled with a durable yellow polyethylene tag that reads “CAUTION Fiber Optic Cable” and includes blank spaces for adding (1) fiber count and (2) destination information. An example of a compliant product is VIP Products’ “Caution Write-On Coverall Tag.”

PART 3 - EXECUTION

3.1 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.2 Training

A. Refer to Section 27 00 00 for additional requirements.

3.3 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.4 General

A. The Contractor shall match the Owner’s standard labeling scheme.

B. Clean surfaces before attaching labels.

C. Install all labels firmly. Labels attached to terminating equipment such as backboards, faceplates, 110 blocks, and patch panels shall be installed plumb and neatly on all equipment.

3.5 Labeling of Cabling and Termination Components

A. Backboard and Equipment Racks

1. Backboards and equipment racks shall be labeled by the Contractor identifying the telecommunication room. Additionally, equipment racks shall have an alpha character after the room number unique to that particular communications closet. For example, TR1-A would be the first rack in TR1.

2. Character height shall be 1-inch (minimum).

B. Cabling

1. Horizontal cables shall have a machine generated wrap around cable label within 4" of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standards. Character height shall be .25" (minimum).

2. Voice/data/video backbone cables shall have a machine generated wrap around cable label within 12" of each end of the cable. Label shall be clearly legible and meet TIA-EIA 606 standard. Character height shall be .5" (minimum).

3.6 Fiber Optic Backbone, Riser Cables, and Termination Components

A. All fiber optic backbone and copper (inter-building, riser, and tie) cables shall be identified AT BOTH ENDS with a designation that identifies where the opposite end of the same cable terminates (e.g., equipment room or telecommunications room I.D.). In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.

B. Each fiber optic termination panel shall be clearly labeled indicating the destination of the cable(s) and the fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

3.7 Standard Information Outlet (SIO) Faceplates

A. All faceplates shall be clearly labeled indicating the destination of the cable(s) (telecommunication room number), the data patch panel(s) letter designation, the data port number(s) on the data patch panel(s), and the voice cable number(s).

B. Telecommunications outlets are to be labeled (1) on the cover of the assembly and (2) on each cable terminated at that location.

C. Station cables shall be labeled within two inches of the cable end.

3.8 Data Patch Panels

A. All data patch panels shall be clearly labeled indicating the telecommunication room number, the data patch panel letter designation, and the data port number on the data patch panel (ports 1 through 48). Each telecommunication room shall start with data patch panel 'A' and continue through the alphabet.

B. A data port schedule for each telecommunication room shall be created in spreadsheet format (Excel) with the telecommunication room number, data patch panel letter designations, data port numbers, and room numbers identified in the spreadsheet. In addition, for each data patch panel port, a field shall be provided in the spreadsheet for the Owner to manage the cabling infrastructure by recording the device and any special notes pertaining to the room utilizing the data cable terminated to the port.

C. Refer to Telecommunication "T" Series Project Drawings for standard information outlet faceplate and data & voice patch panel labeling scheme requirements. A sample of the data and voice port schedules is to be provided to the Owner, in the cable record book and in electronic format (Excel spreadsheet), with final documents provided on the Project Drawings.

3.9 Fiber Optic Cables and Termination Components

A. All fiber optic cables, termination enclosures and connector panels, and splice closures shall be clearly labeled.

B. In addition, labeling of all fiber optic cables shall include the number of fibers in the cable.

C. Each fiber optic termination panel shall be clearly labeled indicating (1) the destination(s) of the cable(s) and (2) fiber number of each fiber position. The cable identifiers are to be secured to (1) the side and (2) the front cover of the panel enclosure.

3.10 Ground System Labeling

A. All grounds shall be labeled as close as practical to the point of termination (for ease of access to read the label). Labels shall be nonmetallic and include the following statement: “WARNING: If this connector or cable is loose or must be removed, please call the building telecommunications manger.” Refer to ANSI/TIA/EIA 606 for additional labeling requirements.

End of Section

27 40 00 – AV/MULTIMEDIA GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. Successful bidder shall provide, install, configure, and provide warranty service for audiovisual systems, including displays, audio/video/graphics switching and distribution systems, integrated control systems, and other equipment as described herein.

1.2 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 23 – Pathways for Technology Systems

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 15 00 – Communications Horizontal Cabling

F. Section 27 16 00 – Communications Connecting Cords

G. Section 27 18 00 – Communications Labeling and Identification

H. Section 27 41 00 – Audio Visual Systems

1.3 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.4 Reference Standards and Codes

A. Refer to Section 27 00 00 for additional requirements.

B. Giddings, G. H. Philip. *Audio Systems – Design and Installation*.
Focal Press, 1990.
Focal Press, Elsevier Inc.
30 Corporate Drive, Suite 400
Burlington, MA 01803

C. *AV Installation Handbook, Second Edition.*
InfoComm International, 2009.
11242 Waples Mill Road, Ste. 200
Fairfax, VA 22030

D. *Audiovisual Systems Performance Verification (ANSI/Infocomm 10:2013)*
InfoComm International, 2013.

11242 Waples Mill Road, Ste. 200
Fairfax, VA 22030
http://www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/35975.htm

E. *Dashboard for Controls Template, Design Reference, and Integrators Guide.*
InfoComm International.
www.infocomm.org/cps/rde/xchg/infocomm/hs.xsl/35324.htm

F. Copyright Act of 1976
U.S. Copyright Office
101 Independence Ave. S.E.
Washington, DC 20559
Phone: (202) 707-3000

1.5 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

B. Primary AV Contractor shall have at least one (1) employee assigned to the project in a design or management role, and at least one (1) employee assigned to the project in an installing technician role, holding at least one of the follow certifications:

1. CTS (InfoComm International)
2. CTS-I (InfoComm International
3. CTS-D (InfoComm International)
4. EST-L2 (National Systems Contractor Association)

C. Refer to subsequent sections for section specific qualification requirements.

D. Contractor shall hold appropriate Audiovisual Provider of Excellence (APEx) certification.

1.6 Pre-Construction Submittals

A. Refer to Section 27 00 00 for additional requirements.

B. Structurally Mounted Elements: Including but not limited to monitors, projectors, projection screens, and loudspeakers.

C. Frequency Assignment Plans: Provide for all wireless microphones.

D. Custom Engraving: Layout and labeling/engraving of custom products including wall plates and interconnection panels. Provide engraving detail with material and finish detail.

E. Power Distribution: Plan for distribution and switching of AC and DC power to all audiovisual devices, including sequencing order of outlets and banks. Time delay to be field configured as necessary for proper system power up and down.

1.7 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.8 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

B. Quick-Reference Guides: Contractor shall create a concise quick-reference guide covering normal system operation and basic troubleshooting procedures for each room/system type. Length of each

quick-reference guide shall be commensurate with the information needed for successful operation, subject to Owner approval.

1. Upon Owner approval, Contractor shall provide two (2) laminated copies and one (1) digital copy for each room/system type.

C. Serial Numbers: Contractor shall provide a list of serial numbers for all supplied components with serial numbers and with a unit price greater than $99. Organize list by room/system type.

1.9 Correction Period

A. Length of Period: Contractor shall offer a one year correction period to Owner for this system. Contractor shall repair all equipment and cabling problems at no additional cost to Owner during the correction period.

B. Commencement: Correction period shall begin at date of Final Acceptance.

C. Final Acceptance: shall be defined as the date at which all contract work (save for a correction period) is complete, including punch list completion & verification, closeout submittals, and written verification by the Owner is obtained by the Contractor that the systems have been accepted.

D. Response: Contractor shall respond by phone within two (2) hours to calls for service or assistance from Owner during normal business hours for the duration of the correction period.

E. On-site Response: Contractor shall respond on-site within eight (8) business hours from the time of the initial phone contact in the event that the issue cannot be resolved over the phone.

F. Equipment on Loan: Contractor shall loan equipment for any broken, defective, or non-functional equipment that cannot be repaired and returned within one week. Contractor shall provide shipping, delivery, and integration at no additional cost to Owner. Equipment shall be comparable in size, speed, brightness, and relevant performance specifications, as determined by Owner.

G. Projection Lamps: Projection lamps are to be warranted by Contractor for a minimum of 90 days, or the rated life expectancy of the lamp, whichever comes first.

H. Damaged Equipment: Equipment that is damaged due to intentional misuse, abuse or negligence is not covered under this warranty; however, Contractor shall assist Owner in putting the system back in working order in the shortest possible timeframe while charging normal service rates for labor and equipment.

1.10 Ownership

A. Property Rights: Contractor assigns to Owner any and all intellectual property rights and applications made by Contractor, or its agents or employees in connection with the performance of this contract. Contractor also acknowledges and agrees that services rendered in connection with the performance of this contract shall be a “work made for hire” within the meaning of Section 201 inventions of the Copyright Law of 1976.

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Product Specifications

A. Provisions: Product specifications are provided in subsequent sections to Contractor for the appropriate configuration and/or provision of accessories as well as for a guide to indicate key features for possible substitutions.

B. Where wireless microphone systems are specified, Contractor shall determine optimal frequency range for final product selection and submit Manufacturer's recommended frequency band for Owner and Consultant approval prior to ordering equipment. Contractor shall provide congruent frequency band products where like systems are specified for interoperability of components. Where three (3) or more wireless microphones are specified within the same system, Contractor shall provide and install necessary antennae distribution for optimal performance, to be submitted for Owner and Consultant approval during pre-construction phase.

2.3 Miscellaneous Material

A. Required Equipment: Contractor shall provide additional system components typically and reasonably required to make system operational even though not specifically indicated in Drawings, Appendices or Specifications including, but not limited to, cable, connectors, connecting accessories, adaptors, power supplies, power strips, rack mounting adapters and shelves, cover plates and closure panels, relays and switches, remote antenna mounts, terminal blocks, and related connector and termination hardware required by but not supplied with the equipment.

B. Blank Fill Panels: Contractor shall provide blank fill panels to cover any openings in equipment racks provided under this contract whether specified in the equipment schedules or not. Fill panels shall match finish of specified rack hardware.

C. Power Distribution Strips: Contractor shall provide power distribution strips as necessary for distributing power within equipment racks and consoles. Strips shall be UL listed, be securely mountable, and appropriate for professional installation.

D. Wall Openings: Contractor shall provide blank faceplates to cover any unused openings within the project area. Faceplate type and finish to match electrical outlets in the project.

2.4 Power Devices

A. Refer to Section 27 00 00 for additional requirements.

B. All audio amplifiers shall be on sequenced outlets.

2.5 Cable

A. Cable shall be provided and installed as detailed herein. Cable installed that does not conform to these standards or that has not been given prior approval by Consultant shall be removed by Contractor and replaced at Contractor's sole expense.

B. Plenum: Plenum-rated cables shall be used where required by code or by best practices. All cables run beneath raised floor shall be plenum-rated.

C. Installed Video: Video signal coaxial cables shall have #18 solid copper center conductor, gas-injected high density Polyethylene or Fluorinated Ethylene Propylene insulation, copper braid shield of at least 95% coverage and 100% dual-sided foil and black PVC jacket unless color is otherwise noted. Cable shall be designed as a low loss serial digital video cable. Belden 1694A, WestPenn 6350, Canare L-5CFB, Liberty 18-CMR-SD, or equal. Plenum cable, Belden 1695A, WestPenn 256350, Liberty 18-CMP-VID-COAX, or equal.

D. Flexible Video: Short video cables that are intended to be moved or adjusted on a regular, frequent basis may be constructed of a stranded bare copper center conductor RG-59/equivalent cable with

>94% copper braid shield and polyethylene dielectric. Canare LV-61S, Belden 1505A, WestPenn 819, or equal. Plenum cable, Belden 1506A, WestPenn 25819, or equal.

E. High Resolution RGBHV Graphics/Video: Cable type and size shall be selected to provide a minimum of 250 MHz bandwidth (-3dB) at over the length of each RGBHV signal path from source to display, including losses and gains through cable loss, signal processing, switching and distribution equipment. Manufacturer shall designate cable as suitable for high-resolution use. Extron MHR-5, Liberty RGB5C-25-CM or equal. Plenum cable, Extron MHR-5P, Liberty RGB5C-25-CMP, or equal.

F. Installed Line Level and Microphone (single line): Audio signal cable shall have twisted pair #22 stranded tinned copper conductors, polyethylene conductor insulation, aluminum-polyester foil shield, #24 stranded tinned copper drain wire and chrome PVC jacket. Belden 8761, West Penn 291, Canare L-2T2S, Liberty 24-2P-STAR, or equal. Plenum cable, Belden 88761 or equal.

G. Portable Microphone, Enclosure and Breakout Line Level Audio: Cable shall have 4 conductors per channel arranged in star quad double-balanced pairing, #24 stranded conductors of at least 40 tinned annealed copper wires, 100% coverage wrap shield, tinned copper braid shield of approximately 50% coverage, uniformly round form and black PVC jacket. Canare L-4E6S, Belden 8723, WestPenn 355, or equal. Plenum Cable, Belden 88723, Liberty 24-4P-PLCSH-WHT, or equal.

H. Broadband Video Antenna Cable: For runs shorter than 15', RG-59. For runs 15'-50', RG-6.

I. Wireless Microphone Antenna Extension Cable: 50-Ohm coaxial cable, or as directed by microphone manufacturer.

J. Loudspeaker Wire: 14 AWG minimum.

K. UTP Cable: Shall be consistent with Project standards for CAT-6A cable, unless otherwise noted in specification or recommended by hardware manufacturer for use with their equipment.

L. Control: Shall be as recommended by equipment manufacturer, with the appropriate number of conductors for the application.

M. Cable Construction: Contractor shall fabricate interconnecting cables using products defined in this section unless equipment manufacturer-provided cable is of a specialized or proprietary nature. Pre-manufactured cables are subject to prior approval by Consultant.

N. Labels: Labels shall include a white paper or vinyl slip with typed or machine printed designations, secured in place with a wider section of clear heat shrink tubing or integral clear adhesive-backed plastic.

O. Terminations: Provide specialized terminating hardware as required.

P. Schedule: Contractor shall submit schedule prior to installation for Consultant review indicating cable types that will be used on the project.

2.6 Connectors

A. Connectors shall be provided and installed as detailed herein. Connectors installed that do not conform to these standards or that have not been given prior approval by Consultant shall be removed by Contractor and replaced at Contractor's sole expense.

B. HDMI (Video/Audio/Control): Cables to be factory-terminated with molded strain relief.

C. BNC (Video): Video signal BNC connectors shall be 3-piece crimp-on type with insertion barrel and ferrule, and gold flashed crimp-on center pin. Barrel shall provide full circumferential contact with the braid. Fittings shall be sized to fit the cable. Canare BCP-C series or equal. Crimping and die tools shall be Canare TC-1 Hand Crimp Tool with appropriate TCD die sets or equal.

D. RCA (Video): Video signal RCA connectors shall be 3-piece crimp-on type with gold flashed center pin, Canare RCAP-C series or equal. Crimping and die tools shall be Canare TC-1 Hand Crimp Tool with appropriate TCD die sets or equal.

E. F (Video): Video signal F connectors shall be 3-piece crimp-on type with gold flashed crimp-on center pin. Canare FP-C series or equal. Crimping and die tools shall be Canare TC-1 Hand Crimp Tool with appropriate TCD die sets or equal.

F. BNC (RGBHV Graphics): Graphics signal BNC connector shall be crimp-on type with insertion barrel and ferrule, and gold flashed crimp-on center pin. Barrel shall provide full circumferential contact with the braid. Fittings shall be sized to fit the cable. BNC manufacturer, model and tools as recommended by the manufacturer of the RGBHV/graphics cable.

G. XLR: Strain relief shall be sized to fit the cable. Connector shell shall be isolated from all contacts. Neutrik CA-NC series or equal.

H. Mini-XLR: Strain relief shall be sized to fit the cable. Connector shell shall be isolated from all contacts. Switchcraft or equivalent.

I. Phono (RCA): Phono/RCA connectors shall have gold contact and solid center pin with metal strain relief. Canare F-10 or Canare F-09 or equal.

J. Phone (1/4 inch): Reinforced one-piece body shall have brass bar running length of handle. Canare F-15 (TS) or Canare F-16 (TRS) or equal.

K. Mini (1/8 inch): Shall be Canare F-11 (TS) or Canare F-12 (TRS) or equal.

L. RJ45: RJ45 jacks that are field-terminated shall be punch-down type. All flexible connectivity to AV devices shall be factory-molded patch cables. Where a field-terminated plug is required by manufacturer recommendations, Contractor shall use appropriate connector type to the type of cable used (solid vs. stranded).

M. Shielded cable to be terminated with shielded connectors or as required by manufacturer recommendations.

N. DM, DM8G+: Shall be Crestron shielded RJ-45 and fiber connectors, as recommended by manufacturer of DM or DM8G+ system.

O. DX, DX-LINK: Shall be AMX shielded RJ-45 and fiber connectors, as recommended by manufacturer of DX or DX-LINK system.

P. Schedule: Contractor shall submit schedule prior to installation for Consultant review indicating connectors that will be used on the project.

2.7 Interface Panels

A. Finish: Interface plates and connector panels shall be as indicated on Drawings and as specified herein. Finish on custom wall interface plates shall match that of electrical and other work and shall be coordinated with Consultant prior to ordering. Connector panels in equipment racks shall match finish of rack frame and specified/provided blank panels unless called out otherwise in equipment schedules.

B. Floor Boxes: Floor box plates shall be provided wherever connectivity through a floor box is indicated on drawings.

C. Labels: Interface plates and connector panels shall be engraved to show connector functionality. Engravings shall be finished with a contrasting color to plate finish.

D. Connector Placement: Verify connector layout detail for custom panels

E. Box Mounts: Wall and floor interface plates shall mount to appropriate electrical conduit boxes unless indicated otherwise.

F. Cut-ins: Where no box is provided, Contractor shall cut in appropriate opening for plate, and provide appropriately sized mud-ring/caddy to securely attach plate to wall.

G. Rack Blank Panels: Contractor shall provide all blank rack panels necessary to fill opening in the front of AV equipment racks, whether specified in the equipment schedules or not.

2.8 Fire Stopping Materials

A. Refer to Section 27 00 00 for additional requirements.

PART 3 - EXECUTION

3.1 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.2 Training

A. Refer to Section 27 00 00 for additional requirements.

3.3 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.4 Equipment

A. As required by Section 27 00 00.

1. Safety: Contractor shall use proper structural installation techniques and maintain a minimum 5:1 safety margin.

2. Custom Mounting Finish: Custom mounting hardware shall be painted by Contractor to match either color of wall, ceiling or equipment, at Consultant's discretion.

3.5 Spare Parts and Remote Controls

A. Projector lamps and filters

B. Remote controls and batteries

C. Adapters

3.6 EDID and E-EDID

A. TBD

3.7 Interconnection

A. As required by Section 27 00 00.

1. Interpretation: Contractor shall make system interconnections as indicated on Drawings and specified herein. Contractor shall interpret Drawings using an understanding of the equipment and general system topology (both existing and future/specified). Contractor shall provide power and control lines to and from power supplies, remotely controlled equipment and other devices even though not explicitly indicated on Drawings or listed in equipment tables.

2. Additional: Contractor shall be responsible for associated equipment signals not specifically documented in provided drawings. These include synchronizing signals, transmitting and receiving antennas, and LAN connections to equipment provided and/or installed by Contractor.

3. Exceptions: Prime Contractor shall be responsible for unrelated low voltage wiring such as data and voice connections except as they pertain to interface boxes, interface plates, and integrated control systems.

3.8 Cable Management

A. As required by Section 27 00 00.

1. Above Ceiling: Cabling located above ceilings shall be tied off to and supported by ceiling supports or other structures at a minimum of eighteen (18) inches above the ceiling.

2. Not on Ceiling: Cabling shall not lie on the ceiling.

3. Wall Cabling: Cables installed in a horizontal fashion along wall surfaces shall be installed in surface raceway approved by Owner and Consultant.

4. Floor Cabling: Cabling placed at floor level such as microphones shall be installed on the floor in the shortest possible route to the nearest wall considering traffic patterns and in an enclosure designed for that use and offering protection from foot traffic.

5. Desk Cabling: Where a cable is installed inside desk furniture, a means of protecting the cables and holding cabling to a fixed surface shall be installed.

6. Grommets: Holes in horizontal furniture surfaces for cable pass-through shall be provided with appropriate sized grommet. Grommet shall be black unless otherwise specified or required.

7. Stub-ups: Where conduit is stubbed-up through the floor and exposed, Contractor shall wrap cables with black expandable sleeving and secure at least three (3) inches below level of conduit top.

a. Where conduit is stubbed-up through floor and concealed within furniture, Contractor shall install tether comprised of aircraft cabling to limit the distance furniture may be moved away from stubbed-up conduit. Cabling service loop exiting stubbed-up conduit and entering furniture shall be longer than the corresponding tether, providing protection against movement of furniture that would otherwise damage installed cabling.

8. Umbilicals: Exposed cable umbilicals, such as those between instructional furniture and a floor- or wall-mounted plate, shall be covered in black expandable sleeving, with neatly finished ends (heat-shrink or Consultant-approved method).

3.9 Connector Termination

A. As required by Section 27 00 00.

1. Video Connectors: Video connectors (BNC, RCA, and F) shall be terminated using a crimp tool or dies designed specifically for the connectors being applied.

2. XLR Connectors: Terminate XLR type connectors wired pin 2 high, pin 3 low, and pin 1 shield.

3. UTP: UTP cable shall be terminated with appropriate crimps tools or tools specified by manufacturer. Refer to 27 40 00.

3.10 Grounding

A. Audiovisual equipment racks shall be grounded to the telecommunication grounding system with a minimum 6 AWG grounding cable. Refer to Section 27 00 00 for additional grounding requirements.

3.11 Testing & Inspection

A. General Information: As required by Section 27 00 00.

B. Notification: Prior to start of testing, provide a list to Consultant of test equipment make, model numbers and calibration dates that will be used.

C. Testing: Contractor shall perform complete testing on system before inspection. Selected systems may be retested during inspection at Owner's discretion.

D. Display/Output checks: Contractor shall verify that visual and audio outputs from the system are high-quality and without noticeable distortion or feedback at normal operating levels.

E. Wiring and Labeling: Contractor shall check all inputs and outputs for correct wiring and labeling.

F. Loudspeakers: Contractor shall measure the impedance of each speaker line leaving the equipment racks. For full range devices, use a frequency of 1000 Hz. For band limited devices, use a frequency appropriate for the operating range of the transducer. When documenting results, Contractor shall include the calculated impedance based on number of units on a line and the size and distance of the run. Contractor shall correct any field readings that differ more than 20% from the calculated impedance. Contractor shall use an electronic polarity checker to test each reinforcement speaker. Speakers shall have the same relative polarity.

3.12 Computer Graphics

A. Computer graphics shall be crisp and focused with respect to color alignment. If color alignment is not registered properly, Contractor shall identify source of problem and correct. EDID and other auto-registration features shall be set within AV equipment where required for optimal system performance.

3.13 Training

A. General Information: As required by Section 27 00 00 and following section(s).

B. Coordination and Personnel: Training shall be coordinated with Owner's schedule, and Contractor personnel who provide training are subject to Owner's approval.

3.14 Project Closeout

A. Completion: System shall be considered complete when all of the following has occurred:

1. Testing has been completed to the satisfaction of Owner and Consultant.
2. Punch-listed items have been addressed to the satisfaction of Owner.
3. As-built drawings and system documentation has been turned over to Owner and Consultant.
4. Complete operational training has been conducted with Owner's staff.
5. System Commissioning Process has been completed.

B. Acceptance: Contractor shall secure written Acceptance of systems in the form of authorized Owner signature on Acceptance Document. This shall constitute the Date of Acceptance.

End of Section

27 41 00 – AUDIO VISUAL SYSTEMS

PART 1 - GENERAL

1.1 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. Provide audio visual systems as well as training and warranty services for those systems as described herein.

1. Elementary Classroom AV System (in renovation areas)

2. High School Classroom AV System (in addition area)

1.2 Allowances

A. Refer to description of interactive flat panel displays in Part 2.

1.3 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 23 – Pathways for Technology Systems

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 15 00 – Communications Horizontal Cabling

F. Section 27 16 00 – Communications Connecting Cords

G. Section 27 18 00 – Communications Labeling and Identification

H. Section 27 40 00 – AV/Multimedia General Requirements

1.4 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 and 27 40 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.5 Correction Period

A. General Information: Products shall be covered by Contractor correction period as required by Sections 27 00 00 and 27 40 00.

B. Correction Period: Contractor’s obligation for correction period shall not abrogate manufacturers’ warranty periods.

C. Commencement: Correction Period begins on Date of Acceptance.

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Interactive Flat Panel Displays (Allowance)

A. The General Contractor shall hold an allowance number for interactive flat panel displays, mounts, and carts until a later date when the Owner will have to select a preferred manufacturer and model to be provided.

B. The AV Contractor shall not price the equipment listed in this interactive flat panel section as part of their bid; all other AV equipment in subsequent parts, however, shall be included.

C. Installation of the flat panel displays shall be included in the Contractor's bid. This includes mounting displays on the walls, connecting all associated cabling, and testing them for functionality.

D. Display description

1. Physical requirements:

a. Sizes as noted below under anticipated models

b. Ultra HD resolution

c. Minimum of 2 x HDMI connectors, with at least one HDMI 2.0

d. Minimum of 2 x USB connections, with at least one USB 2.0 and one USB 3.0

e. Built-in speakers, minimum of 2x12W

f. Hard button controls for common functions: on/off, volume up/down, source select

2. Functional requirements:

a. Minimum of 20-point touch, 10-points of writing

b. Finger, pen, and stylus touch capability

c. Software suite included (no ongoing license fees)

3. Included accessory modules & interfaces:

a. Android PC module

b. Wireless presentation module

c. Wifi connectivity module

E. Anticipated Manufacturer & Model:

1. Clear Touch 6000U 75" interactive flat panel (typical locations)

2. Clear Touch 6000U 86" interactive flat panel (culinary classroom at high school)

3. Clear Touch 6000U 65" interactive flat panel (cosmetology classroom at high school)

4. Provide all equipment with 5 year manufacturer warranty

2.3 Classroom AV System Description

A. The classroom AV system is based around an interactive flat panel display.

B. The classrooms will have wall-mounted displays, requiring in-wall AV cabling from the teacher station to the display to support HDMI and USB connectivity. This system applies anywhere an “FP#” symbol appears on the technology plans, regardless of the name of the room or whether it is truly a ‘classroom’. Refer to separate HDMI and USB cabling sections below for additional information.

C. The displays shall be mounted using height-adjustable non-motorized mounting solutions. Refer to separate mounting section below for additional information.

D. These systems only apply to the new or renovated rooms. Rooms that are existing to remain shall not receive new AV systems.

2.4 Mounting Solutions for Interactive Flat Panels

A. Provide a wall mount for each flat panel location that meets the following requirements:

1. Minimum of 15.75” of vertical travel with easy, one-finger use
2. Non-motorized/electric height adjustable solution
3. UL listed
4. Universal mounting pattern compatibility - 200x200 – 800x400mm
5. Provide size as necessary to support the anticipated display size and weight at each location
6. Provide with accessories necessary for mounting, such as Chief FHB Series hardware kit for larger displays

B. Confirm with Architect and Owner which display models are being provided prior to ordering the mounting solutions.

C. Coordinate blocking requirements with General Contractor.

D. Manufacturers

1. Chief Manufacturing Fusion Dynamic Height Adjustable Wall Mount Series
2. Balance Box
3. Or approved equal

2.5 HDMI Inputs/Connectivity

A. AV Contractor shall provide HDMI input plates where indicated on plans. Due to HDMI distance limitations, anywhere the cable distance exceeds 30 feet, an acceptable solution shall include some form of extension. Extension can be via active HDMI cables (ex: RedMere), UTP/XTP extenders, or fiber optic HDMI cables. At locations where the end-to-end cable distance is 30 feet or less, commercial-grade passive HDMI cables may be used. Contractor shall be responsible for providing a cable channel that is reliable and functions with all source devices the Owner may use.

B. Acceptable solution shall remain entirely concealed, with only the faceplate visible. The rest of the solution – cabling, extender boxes, boosters, etc. – shall be located in walls, above ceiling, and/or behind flat panel display. Contractor shall refer to the architectural drawings, especially the reflected ceiling plans (RCP), for additional information on possible cable routes.

C. Acceptable solution shall support 4K HDMI transmission to plan for future sources and displays.

D. Acceptable solution shall be manufactured by a Pro AV manufacturer with 5+ years in the AV industry and an existing install base in central Texas.

E. Acceptable solution shall fit inside the conduits and backboxes shown in the rough-in details on the technology drawings.

F. Wherever cables are routed above ceiling, they shall carry a CMP rating.

G. Provide with turnover cables, one for each HDMI input location. Typical cable length shall be 10 feet.

2.6 USB Inputs/Connectivity

A. AV Contractor shall provide a USB input plate at the “TWS” with extension to the ceiling enclosure. Due to USB distance limitations, acceptable solutions shall include some form of extension. Typically, this is achieved using UTP/XTP extenders.

B. Acceptable solution shall remain entirely concealed, with only the faceplate visible. The rest of the solution – cabling, extender boxes, boosters, etc. – shall be located in walls, above ceiling, and/or inside ceiling enclosure.

C. Acceptable solution shall support at a minimum USB 2.0.

D. Acceptable solution shall be manufactured by a Pro AV manufacturer with 5+ years in the AV industry and an existing install base in central Texas.

E. Acceptable solution shall fit inside the conduits and backboxes shown in the rough-in details on the technology drawings.

F. Wherever cables are routed above ceiling, they shall carry a CMP rating.

G. Provide with turnover cables, one for each USB wall plate and one for each USB ceiling enclosure endpoint.

2.7 Faceplates

A. The Contractor shall provide faceplates and inserts to support all connectivity shown on the technology detail sheets.

B. Refer to rough-in details for backbox sizes.

C. Coordinate faceplate and insert colors to match electrical. Confirm with Architect prior to purchasing.

2.8 Product Specifications

A. General Information: As required by Sections 27 00 00 and 27 40 00.

B. Expanded Schedule: Products shall be provided in type and quantity as listed on Appendix A – Equipment Schedule. Substitutions are subject to prior Consultant approval.

C. Interconnections: Contractor shall be responsible for providing populated, grommeted, or blank cover plates for all wall and floor box openings intended for audiovisual systems.

D. Twisted Pair (TP) Category Cabling: Contractor shall use twisted pair Category cable as recommended by manufacturer of transmission equipment for optimal bandwidth and signal timing. Where cable type is not specified by manufacturer, Contractor shall use shielded twisted pair Category 6 cabling. Cable type shall be detailed in pre-construction submittals with any deviations from manufacturer recommendations expressly noted.

E. Equipment Schedule Details: The following custom/modified items are referred to in the equipment schedules.

F. Mounts: Contractor shall fabricate mounts for projectors, monitors, loudspeakers, cameras, etc. as necessary, and shall modify standard mounts as required for optimal mounting configurations. Intended hardware shall be detailed in shop drawing submittals.

1. Custom mounting configurations shall be submitted in shop drawings for review.

2. Contractor shall provide all hardware as necessary, including flanges, Unistrut, threaded pipe, column extensions, yokes, clamps, threaded rod, aircraft cable, and any other hardware required to securely mount equipment.

3. All ceiling tile penetrations shall be neatly finished with a plate, grommet and/or escutcheon ring.

2.9 Misc. Parts & Materials

A. General Information: As required by Sections 27 00 00 and 27 40 00.

B. Laptop Cables: Contractor shall provide all interconnection cables shown on the project drawings, including breakout cables for laptops. Laptop breakout cables shall have integrated audio, where applicable, and shall be equal or greater in quality to the Extron 26-490-series and Extron 26-650-series of cables. Substitutions are subject to prior Consultant approval.

C. Keys: Keys for like equipment shall be identical.

D. Wireless Transceivers: Where wireless transceivers are specified (including, but not limited to wireless microphones, wireless assistive listening devices, etc.) Contractor shall verify frequency band range of existing Owner wireless systems. Contractor shall provide wireless transceiver system(s) compatible with existing equipment for interoperability.

E. Cable Sleeving:

F. Shall be black expandable sleeving, with ends neatly turned under 2", held in place either by nylon tie-wrap, or heat-shrink tubing. Tie wraps, if used, shall not deform cables within the umbilical. Cables requiring sleeving include:

1. Exposed cabling outside of wire management in console furniture.

2. Cable umbilicals connecting to or from wall, floor, or ceiling plates consisting of more than one wire.

G. Contractor shall coordinate as necessary so that all low-voltage cabling (including Ethernet) are included in a single umbilical.

H. CATV: CATV patch cords shall be run inside AV cable umbilical where connecting to a wall plate/panel or monitor.

PART 3 - EXECUTION

3.1 Equipment Location

A. Coordination: Where device locations are not shown on rack/console elevations and project drawings, Contractor shall coordinate with Consultant to identify desired/optimal locations.

B. Contractor shall verify all wall-mounted monitor mounting heights on preconstruction submittals.

3.2 Equipment Configuration

A. Integrated Control System (ICS): Refer to Section 27 41 70 for ICS configuration.

B. Labeling: Contractor shall configure all equipment for normal use, including setting of levels and presets. Small adhesive labels shall be affixed to equipment indicating nominal levels and settings.

C. EDID, E-EDID: Where devices allow for the customization of EDID information, Contractor shall configure EDID settings of all applicable devices such that the audiovisual system is optimized.

3.3 System Testing

A. Contractor shall check that all cables are properly labeled and secured prior to substantial completion inspection.

B. Contractor shall ensure that all work areas are clear of all debris, tools, empty boxes, and extra parts prior to substantial completion inspection.

C. Prior to the substantial completion inspection, Contractor shall notify the Consultant that all items listed below are complete:

1. Contractor shall ensure that all standard functions of equipment are functional.

2. Contractor shall verify all input and outputs of the system for signal quality.

3. Audio: Contractor shall verify all sources are free of destructive noise (excessive noise floor, hiss, grounding interference) and that speakers function properly. The audio system shall be consistent in terms of volume and tone and shall be optimized for the space(s) served by the audio system.

4. Video: Contractor shall verify that all EDID and EDID-D information has been configured at each video transmission and processing device. Where signal processing is present, Contractor shall optimize the video system to native resolution of display devices.

3.4 Training

A. General Information: As required by Sections 27 00 00 and 27 40 00.

B. Contractor shall provide one (1) 60-minute training session for each unique audiovisual room type. Training sessions shall comprise of one half of the time dedicated to instructor led training with the remainder of the session to be used for instructor supervised hands-on end user operation of the system(s):

1. Identification of input locations, source devices, control locations, displays, and other devices requiring end user interaction for successful system operation.

2. Use of control system.

3. Use of source devices and input locations.

4. Switching inputs for each display.

5. Training shall include operation of system in event of control system malfunction – all manual switching and use of remotes.

6. Basic troubleshooting for common user errors.

C. Scheduling: Training shall be scheduled with Owner at least ten (10) days in advance.

D. Quick-Reference Guides: Contractor shall compile quick-reference guide for system operation and basic troubleshooting. Quick-reference guide shall be provided at the training session, and training shall include walking through quick-reference guide steps.

End of Section

27 51 00 – DISTRIBUTED COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 Scope

A. Provide a complete turnkey expansion/renovation of the existing public address and bell system. Provide all components, functions, and connectivity necessary to integrate the renovation and addition area speakers with the existing system.

B. System installation shall include but not be limited to: installation, programming, and configuration of system components as well as associated software upgrades, patches, and maintenance for the first year.

C. This scope applies to two schools:

1. Brady Elementary – Renovation of one classroom wing

2. Brady High School – Addition of new Career building

1.2 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 40 00 – AV/Multimedia General Requirements

1.3 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 and 27 40 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.4 Qualifications

A. Contractor shall be an authorized vendor and installer of the following products:

1. Dukane / Carehawk

B. Training: Programmer shall have received manufacturer-provided and/or manufacturer approved training in the configuration of the distributed communications system(s) being provided.

C. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) offered by the manufacturer(s) of the distributed communications system(s) hardware.

D. Submittal: Certification certificate shall be submitted with distributed communications system(s) submittals.

PART 2 - PRODUCTS

2.1 General Description

A. This project is an addition to the existing Brady High School and a renovation of part of the existing Brady Elementary School. The two schools have different existing PA systems that shall be renovated and expanded.

B. All existing features shall be supported in the renovation and addition areas. Existing features differ between the two campuses.

C. Provide speakers, volume controls, and other devices where indicated on the technology floor plans.

2.2 Elementary School Expansion of Existing System

A. The Elementary School has a very basic PA system consisting of the following major components:

1. Bogen TPU100B

2. Peavey UA 35TII

B. Contractor shall provide new cabling, speakers, and other components as necessary and connect these to the existing system to support all device locations shown in the renovated classroom wing.

2.3 High School Expansion of Existing System

A. The High School has an existing Dukane system installed. The Contractor shall add an expansion module or network interface card/module to this existing system and expand it into the new addition areas. Provide all additional components as necessary for this turnkey expansion. If replacing components of the existing Dukane headend equipment is necessary to provide PA functionality in the new addition, then the Contractor shall include this in their bid.

2.4 Paging Zones

A. Elementary School

1. Existing system only supports all-call; no separate zones required in renovation area

B. High School

1. Provide a single output from the system for each paging zone

2. The following zones shall be configured:

a. Hallway/common areas

b. Classrooms (individual zone/circuit for each classroom, so they are individually addressable)

c. Outside speakers

3. There shall be all-call zones and grouped zones such as an entire floor or wing

2.5 UPS Backup

A. System shall include UPS battery backup for emergency paging.

1. UPS shall be sized according to operational power required to maintain system functions. It shall support the entire system at full operation (ex: music playback) for a minimum of 30 minutes.

2. UPS shall be rack mountable

3. UPS shall be remotely manageable

B. Provide UPS solution at new addition for High School

C. Approved manufacturers:

1. Middle Atlantic

2. SurgeX

3. Or approved equal

2.6 Speaker Wiring

A. Local room wiring for speakers and call button shall be cabled with 18AWG stranded cable. Homeruns between headend and room zones shall use a minimum of 16AWG stranded twisted pair cable.

B. Common area loudspeaker zones shall have no more than 25 loudspeakers per homerun zone and be fed with a minimum of 16AWG stranded twisted pair cable.

C. Classroom loudspeakers shall be a single voice-coil type with the voice-coil connected to a 25V constant voltage audio transformer. Each classroom loudspeaker shall be taped at a minimum of 2 Watts. Classroom Loudspeakers shall be lay-in ceiling grid 2' x 2' typical.

D. Common Zone loudspeakers shall be a single voice-coil type with the voice-coil connected to a 25V constant voltage audio transformer. Each loudspeaker shall be taped at a minimum of 2.5 Watts. Common area Loudspeakers shall be lay-in ceiling grid 2' x 2' typical

2.7 Loudspeaker Types

A. Every loudspeaker location on the plans is indicated by a speaker type "S#" that corresponds to a specific speaker model. Provide locations as indicated on the plans and models as indicated in the loudspeaker schedule on one of the technology details sheets.

PART 3 - EXECUTION

3.1 Procedures & Methods

A. The Contractor shall provide rack shelves or rack mounting ears for any equipment that is not rack mountable. All equipment installed using shelves shall be fastened to the rack shelf. If Velcro is used to fasten any equipment, the Velcro must be fastened with screws. Adhesive is not an acceptable means to fasten any equipment.

B. Supplementary equipment within equipment racks, such as special assemblies that are not rack mountable or fastened to rack shelves shall be mounted on painted black high grade wooden boards running vertically on side rails of equipment racks. The same wooden strips shall also be used to support cable tie support bars for lacing cables to equipment.

C. Equipment shall be mounted into racks and consoles, and fully wired and tested, before delivery to job site.

D. Equipment and enclosures shall be mounted plumb and square in relation to the structure.

E. Devices, wire raceways, and equipment, except for portable equipment, shall be permanently attached to equipment racks or building structure and held firmly in place with screws or fasteners. Adhesives alone shall not be accepted as fasteners.

F. All equipment mounting boards in head-end rooms, MER's, electrical, or TR closets shall be painted white or black as location dictates with fire retardant paint. The mounting boards shall be made of high-grade plywood.

3.2 Wire & Cable Requirements

A. Cable installation must follow related TIA/EIA standards and recommendations, including methodology as noted in TIA/EIA 569 - Part 4.6 Ceiling Pathways. Specifically, including sections 4.6.1 General, 4.6.2 Design Guidelines, and 4.6.5 Cable Support.

B. All equipment rack wiring and cabling shall be neatly laced, ends dressed with heat shrink tubing, and all cables shall have service loops between the horizontal tie bar and the connection to equipment. Rack cabling shall be adequately supported with tie wraps or Velcro wire wraps and horizontal support bars to rack frame as it enters or exits the front or back of equipment.

C. There shall be no unmarked cables at any place in any part of any system this includes both in equipment racks and outside of equipment racks. Label markings codes used on cables shall correspond and be shown clearly on as built drawings

D. All cables shall be separated into like groups according to signal or power levels and routed separately to eliminate signal contamination and cross-talk, this includes both in equipment racks and outside of equipment racks.

E. All power cables, control cables, and high level cables shall be grouped to one side of the equipment rack while low level cables shall be grouped to the other side.

F. All cables within equipment racks will use Velcro wire wraps to manage and bundle cables. Velcro strips will be no more than a ¼" wide.

G. All cabling located above ceilings shall be tied off to and supported by ceiling supports or other structures at a minimum of eighteen inches above the ceiling.

H. Cabling shall be placed in conduit where exposed in gym roof joist. Exposed cables shall not be allowed.

3.3 Equipment and Cable Labels

A. All cables, regardless of length, shall be marked with indelible color-coded labels that have unique identifying number that corresponds with those found on the schematic diagrams and as-built drawings.

B. Labels shall be directly hot stamped or factory-stamped with closed sleeve method. Adhesive strip labels may only be used if protected by transparent heat-shrink tubing.

C. Marking codes used on cables shall correspond and be shown clearly on as-built drawings.

D. Provide all proposed wording and / or numbering scheme for labeling to the Consultant for review and written approval prior to procurement or installation.

E. All wall plates shall be labeled with Input and Output identifications and referenced to corresponding operational software or hardware it serves.

F. All labels used must be permanent and secure. Provide labeling as follows unless otherwise noted in a specific section:

1. Provide engraved Lamacoid labels at the front of all equipment mounted in the racks. Labels shall indicate equipment type and model number and correspond to the As-Built drawings for equipment identification.

2. Mount labels on the equipment rack, not on the equipment, and attach in a neat, plumb, and permanent manner. The labels shall be placed on the equipment rack vertical frame (post). If the equipment rack vertical posts have a recessed mid-section, then match label width to fit this recessed section.

3. Labels shall be uniform in size. All adjacent labels shall be sized to match the other labels used for same purpose. Similarly, provide engraved labels of like size in other locations.

4. Provide engraved Lamacoid labels on each equipment rack rear door or console rear panel reading "No user serviceable parts. Refer service to qualified technician."

5. Embossed adhesive labels are not acceptable.

6. All label lettering shall be a minimum of .08" high. Embossed adhesive labels are not acceptable.

7. Position at the left side front top rack space of each equipment cabinet a label that states the name of system Installer with contact information and at the right side a label that states the Design Consultant with contact information.

8. Unless otherwise noted, labels on dark panels shall be black with white letters. Labels on stainless steel or brushed natural aluminum plates or light colored panels shall be white with black lettering.
9. All wall plates shall have input and output connectors labeled in a professional and permanent manner, no hand written labels shall be accepted.
10. Cable and Jack labels shall include room identification with unique cable number, jack location within the room, and MER or TR number.
11. The Contractor shall use actual room identifications in their labeling scheme. Contractor shall obtain written approval from the Owner for the actual room numbers, and labeling scheme, to be used prior to installation.
12. Switches, connectors, jacks, receptacles, outlets, cables and cable terminations shall be logically and permanently marked in a manner approved by the Consultant.
13. Custom panel nomenclature shall be engraved, etched, or screened. Markings for these items are purposely detailed in the construction drawings to ensure consistency and clarity. Verify markings and placement with the Consultant prior to procurement. Submit label sample layouts for Project Consultant's review.
14. All terminal blocks, rack mounted equipment, and active slots of card frame systems shall be clearly and logically labeled in a manner acceptable to the Consultant.
15. All labeling information shall appear on the As-Built drawings as device and equipment cross-reference identifier and servicing aids.

3.4 Connections and Connectors

A. Connections shall be made with approved connectors on cables, terminal blocks, or punch blocks. Crimp style connectors shall be made with proper crimping tool. Two point crimps will not be accepted.

B. RF cable connectors shall be made with hex crimp.

C. Cables shall be terminated with the proper connector specifically produced for use with each type of cable.

D. Video connectors that are not of solder type (HDMI, BNC, RCA, F, etc.) shall be terminated using a crimp tool or dies designed specifically for the connectors being applied.

E. XLR type connectors shall be wired with pin 2 high, pin 3 low, and pin 1 shield.

F. Mechanical connectors must be specially made for type of cable or wire used.

G. Connector adapters will not be allowed in any part of the system.

H. Twist on connectors shall not be allowed.

I. Solder joints will be made with rosin-core solder.

3.5 Interconnection

A. Contractor shall make all system interconnections as necessary for a fully functional system that meets the requirements of the drawings and specifications.

B. Contractor shall provide power and control cables to and from power supplies, remotely controlled equipment and other devices even though such cables are not explicitly indicated on Drawings or listed in equipment tables

3.6 Cable Management

A. Cabling located above ceilings shall be tied off to and supported with cable hangers fastened directly to the structure.

B. Where a cable is installed inside desk or other furniture, a means of protecting the cables and holding cabling to a fixed surface shall be provided.

C. Holes in horizontal furniture surfaces for cable pass-through shall be provided with appropriate sized grommet. Grommet shall be black unless otherwise specified.

D. Provide Service Loops with ample cable at each termination so that plates, panels, and equipment can be removed for service, re-termination or inspection. Provide the following as a minimum:

1. Wall plate outlet box: minimum of ten (10) inches from wall surface to jack.

2. Termination panel: Six (6) inches behind termination panel from cable tie to jack.

3.7 Equipment Racks

A. Install all rack-mounted equipment using steel 10-32 machine screws with Phillips large oval heads or Allen head drives. Screws must have a black oxide finish, and plastic cup washers to protect the equipment panel finish.

B. Provide wire and cable management at the front of equipment and wire and cable support bars at the rear of equipment. Support bars will be used to tie cables for strain relief before connection to the accompanying equipment. Provide sufficient service loops between support bars and equipment.

C. Unused open front rack spaces in equipment racks must be filled with black rack blank spacers (not vents). Equipment rack vents shall only be used at top and bottom of the rack.

D. Place all rack devices requiring adjustments, cleaning, or similar attention so that they will be accessible for such attention.

E. Equipment racks shall be positioned to permit full access for operation and service. This means clearance for door swing and service technician at both front and back of equipment rack.

F. Equipment racks and sensitive components shall be placed so that signals will not be contaminated by induced electromagnetic and electrostatic noise from other electrical devices.

G. All wire and cable to and from the equipment racks shall run across the top of the racks on a ladder cable tray mounted with standoffs from the equipment rack or hung below the ceiling.

H. As a general practice, all power cables, control cables, and high level cables shall be grouped to one side of the equipment rack while low-level cables are on the other side.

3.8 Testing and Adjusting

A. The Contractor will be responsible for adjusting the installed system and notifying the Consultant when system adjustments have been completed:

1. In accordance with Construction Documents

2. As required, to provide the Owner a fully functional system at system turnover

3. As directed by the Consultant

B. Audio System Equalization

1. Using a Real-Time audio frequency spectrum analyzer, such as Audio Control SA-3052 or equivalent, with both 1/3 band and narrow band display, equalize all loudspeaker systems to provide a suitable frequency response as follows:

a. Flat from 60 Hz to 2 kHz + or – 1-1/2db with a 1db per 1/3 octave roll off after 2K

b. Load and save the final normal settings in the DSP as preset one and record same settings including system gain and amplifier level settings in the As-Built Project Manual

C. Notification: When above tests have been completed and system is ready for inspection, notify Consultant in writing at least seven working days prior to inspection. Include in this notice copies of all data recorded, date each test was completed and results of each test. All test data shall be available during inspection process.

3.9 Demonstration

A. The final acceptance, with proof of performance and operational verifications for the installed Audio & Video Systems shall be the responsibility of and performed by the Contractor in the presence of the Consultant and Owner's representative.

B. Final acceptance shall be in accordance with Construction Documents, General Conditions, and Division 27 Technology General Requirements.

C. The Contractor shall notify the Consultant 10 day's prior substantial completion and intended schedule for the final acceptance walkthrough demonstration.

D. Acceptance Testing shall include, but not be limited to the following:

1. Demonstration of all system operations to the Consultant as the Owner's representative.
2. A minimum of two (2) installation technicians provided by the Contractor to assist the project Consultant, as required, during final test verification and final acceptance demonstration.

E. The technicians shall be equipped to perform necessary corrections to the system. They Contractor shall provide test equipment capable of testing any and all parts of the equipment, cabling, or systems.

F. The minimum required test equipment shall include but not be limited to the following:

1. Three (3) two-way radios, that covers the area of testing, for communications between Contractor and Consultant
2. Multi test meter for reading AC / DC Voltage, Amperage, Resistance, and continuity
3. Sound level meter calibrated in db with A, C, and flat filters
4. Audio Tone Generator and audio signal tracer
5. Calibrated Pink Noise Generator
6. Real Time Audio Analyzer (RTA)
7. Audio acoustical pulse polarity / phase tester
8. Computer with installed device software and connecting cables, example DSP

G. The Contractor shall be responsible for equipment adjustments to ensure normal and proper operation. Owner required system adjustments will be made by the Contractor as directed by Owner or Project Consultant during final testing

H. During the final acceptance walkthrough the Contractor shall demonstrate operation of each major component and functional requirement as specified herein.

I. If any portion of the system does not appear to be functioning properly during the final acceptance walkthrough the Contractor shall do further test, along with corrective actions that may be immediately possible. If the need for further corrections or corrective actions does not resolve the issue the demonstration, at the Consultant's discursion, shall be discontinued until the system operates properly.

J. The Contractor shall remain responsible for all equipment, labor, hardware and documentation, in part and in total, until Owner accepts such work or material in writing.

3.10 Owner's Training

A. Owner Training of the completed installation is an important part of the overall success of this project and therefor the installing Contractor shall provide comprehensive system training to the Owner as defined below and with the minimum training hours as specified.

B. Prior to scheduling or delivering Owner Training confirm the following:

1. System as-built documentation must be provided for review to Owner and Consultant.
2. System final walkthrough inspection must be completed.
3. Training materials and program outline must be provided and approved by the Owner / Consultant.
4. Training schedule must be coordinated with the Owner and Consultant.

C. Training is to include:

1. Detailed training plan that meets approval by the Consultant and the Owner
2. Practical and comprehensive operation of system
3. Basic system troubleshooting techniques
4. Digital Video file of each training session. Furnish two edited copies to the Owner

D. Training Hours

1. The Owner reserves the right to establish training times, duration, and training topics within the total training time allotted. Training Session Blocks, as defined below, can at the Owner's request be combined in any combination
2. Provide each group of users, as defined below, with the minimum training hours as specified.
3. Training time shall be defined as those hours specifically set-aside for the sole purpose of training District personnel. Credited time shall not be given for time spent providing instructions to the Owner's staff for a system not completed or that has not passed final acceptance by the Owner and Consultant, or training performed outside of the approved training plan.
4. The Contractor shall issue a certificate of training completion to the trainees, upon completion of their training. Both the trainer and trainee(s) must sign the certificate before Contractor shall receive final payment.
5. The Contractor shall provide a minimum of (8) eight hours of Owner training. This training shall be divided into training session "Blocks" as coordinated with the Owner.
6. The first block session will consist of a two-hour training period and occur when the basic system comes on line. This training shall primarily be intended for the common system operators.
7. The second block will consist of a two-hour training period and will occur as directed by the Owner. This training session shall be structured for high-level users, for example staff champions that will provide instruction to other users.
8. The third block will consist of a two-hour training period to assist the staff champions with training the end users. This training shall consist of a training session structured for Advanced System Configuration and Operational Knowledge needed to maintain and manage all systems. It shall include basic troubleshooting skills.
9. The fourth training session shall be structured as requested by the Owner. Unless otherwise directed, provide a minimum of four (2) two hours of special in-service training for District's

maintenance personnel. This training shall cover system overview and any special maintenance requirements. The owner will designate the personnel to attend this training and the systems to be covered.

E. Training sessions shall cover at a minimum:

1. Basic System Configuration and Operation Knowledge
2. Advance System Configuration and Operation Knowledge
3. Typical system usage
4. Typical User troubleshooting skills
5. Service and maintenance requirements

F. The Owner reserves the right to establish training times, duration, and topics.

End of Section

27 60 00 – PHYSICAL SECURITY GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the general product and execution requirements related to furnishing and installing Physical Security Systems. Physical Security Systems includes Video Surveillance, Electronic Access Control, Intrusion Detection, PLC/HMI systems and their sub systems.

C. This is a 24/7/365 mission critical facility and all systems shall be capable of a 99.99% uptime by utilizing redundant power supplies, enterprise grade components, UPS power and fail over.

D. Contractor shall be responsible for providing complete and functional systems as described in this specification and project drawings.

E. Contractor shall provide low voltage power and control lines to and from power supplies, remotely controlled equipment, and other devices, even though not explicitly indicated on drawings or listed in equipment tables.

F. Contractor shall be, or Contractor shall provide, an Electrical Contractor for provision of high voltage power and conduits/raceway, where necessary.

G. Contractor shall be responsible for any and all related programming and end-user training unless noted otherwise.

1.2 Related Work

A. Section 27 00 00 – General Technology Requirements

B. Section 27 05 00 – Communications General Requirements

C. Section 27 05 23 – Pathways for Technology Systems

D. Section 27 05 26 – Grounding and Bonding for Technology Systems

E. Section 27 11 00 – Communications Equipment Rooms

F. Section 27 15 00 – Communications Horizontal Cabling

G. Section 27 16 00 – Communications Connecting Cords

H. Section 27 18 00 – Communications Labeling and Identification

I. Section 27 51 00 – Distributed Communications Systems

J. Section 27 62 00 – Electronic Access Control System

K. Section 27 64 00 – Video Surveillance System

1.3 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.4 Qualifications

A. Refer to Section 27 00 00 for additional requirements.

B. Training: Programmer shall have received manufacturer-provided and/or manufacturer approved training in the configuration of the physical security system(s) being provided.

C. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) offered by the manufacturer(s) of the physical security system(s).

D. Submittal: Certification certificate shall be submitted with physical security system(s) submittals.

1.5 Pre-Construction Submittals

A. Refer to Section 27 00 00 for additional requirements.

B. Hardware, Application Software, and Network Requirements: A system description including analysis and calculations used in sizing equipment required by the Physical Security Systems. The description shall show how the equipment will operate as a system to meet the performance requirements of the systems. The following information shall be supplied as a minimum:

1. Server(s) processor(s), disk space and memory size

2. Workstation(s) processor(s), disk space and memory size

3. Operating System(s) Software, where software is provided or upgraded

4. Application Software, with Optional and Custom Software Modules supplied in this project

5. Integration Schemes: Proposed connectivity, software, development requirements, and SDK information, for inter-system communication.

6. Network reliability requirements

7. Number and location of LAN ports required

8. Number of IP addresses required.

9. Other specific network requirements, preferences, and constraints

10. Backup/archive system size and configuration

11. Start-up operations

12. Description of site (field) control equipment (Controllers/Field Panels) and their configuration

13. Access control power calculations.

14. Battery backup requirements

1.6 Construction Progress Submittals

A. Refer to Section 27 00 00 for additional requirements.

1.7 Closeout Submittals

A. Refer to Section 27 00 00 for additional requirements.

B. Quick-Reference Guides: Contractor shall create a concise quick-reference guide covering normal system operation and basic troubleshooting procedures for each room/system type. Length of each quick-reference guide shall be commensurate with the information needed for successful operation, subject to Owner approval.

1. Upon Owner approval, Contractor shall provide two (2) laminated copies and one (1) digital copy for each room/system type.

C. Serial Numbers: Contractor shall provide a list of serial numbers for all supplied components with serial numbers and with a unit price greater than $99. Organize list by room/system type.

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 KVM

A. The contractor shall provide a KVM for each rack or cabinet housing a server or multiple servers including servers for access control.

B. The KVM shall have a 19” monitor with integrated mouse pad and keyboard.

C. The KVM shall have video inputs and USB connectors with 8 ports.

D. The KVM shall be IP enabled for remote management.

E. The contractor shall provide with a 4-post to 2-post converter (CPI #12751-719 or equal) when mounted to a 2-post rack.

F. Tripp-lite B020-U08-19-IP

1. Or approved equal

2.3 Refer to individual sections for additional product information.

2.4 Fire Stopping Materials

A. Refer to Section 27 00 00 for additional requirements.

PART 3 - EXECUTION

3.1 Network Time Protocol (NTP) Synchronization

A. All security systems as well as additional integrated systems such as intercom/PA, SQL/database servers and data logging servers shall synchronize to a common NTP server.

B. All systems including servers and workstations shall be within 50ms of each other or less depending on specific system requirements such as failover. The synchronization frequency shall be no less than every 3 hours.

C. The Contractor shall coordinate with the Owner for a NTP server connection. The Contractor shall verify the accuracy of the Owners NTP server before utilizing it.

D. When a reliable NTP server is not available from the Owner the Contractor shall not utilize the built in Microsoft Windows NTP servers or registry tweaks shall not be utilized. The Contractor shall use software such as NetTime (www.timesynctool.com) installed on the appropriate server.

E. Workstations on the private security network shall have an NTP client such as NetTime operating as a Windows service to sync the workstations clock to the same NTP server as the rest of the security systems.

F. When an external internet connection is not available the Contractor shall provide a GPS based NTP server such as the Veracity Timenet or equal.

3.2 Testing

A. Refer to Section 27 00 00 for additional requirements.

3.3 Training

A. Refer to Section 27 00 00 for additional requirements.

B. On-Site Training

1. General: Present, review and describe equipment and materials to the Owner and Owner's operating personnel and fully demonstrate the operation and maintenance of the systems, equipment and devices specified herein.

2. Include with new systems, Contractor to arrange and provide for video recording of each onsite training session.

a. Provide professional video and audio recording of each software screen option with Owner approval of content.

b. Provide end user video recording for all training levels.

3. Training shall comprise two separate levels of training;

a. User Group upon substantial completion of the project.

i. User group training shall include a site/building walk through indicating locations of equipment and their usage.

ii. User group training shall include the operation of workstation capability of system monitoring, command override and report generation.

b. Maintenance Group upon completion of the project prior to close out.

i. Maintenance group training shall include a site/building walk through indicating locations of equipment and their usage at up to six representative sites.

ii. Review of a-build documentation at each controller location.

iii. Troubleshooting techniques in hardware and software.

4. The training shall cover the overall system, each individual system, each subsystem, and each component. The training shall also cover procedures for database management, normal operations, and failure modes with response procedures for each failure. Each procedural item shall be applied to each equipment level.

C. Duration: Refer to the individual sections for the minimum time requirements.

3.4 Warranty

A. Refer to Section 27 00 00 for additional requirements.

B. Furnish and guarantee maintenance, repair and inspection service for the system using factory trained authorized representatives of the manufacturer of the equipment for a period of one year after final acceptance of the installation.

C. Third Party Device warranties are transferred from the manufacturer to the Contractor, which may then transfer third party warranties to the Owner. Specific third party warranty details, terms and conditions, remedies and procedures, are either expressly stated on, or packaged with, or accompany such products. The warranty period may vary from product to product. These products include but are not limited to devices that are directly interconnected to the field hardware or computers and are purchased directly from the manufacturer.

D. Purpose

1. The Contractor shall repair any system malfunction or installation deficiency discovered by the Owner or their representatives during the burn in and warranty period.

2. The Contractor shall correct any installation deficiencies found against the contract drawings and specifications discovered by the Owner or their representatives during the warranty period.

3.5 Examination of Site and Documents

A. Bidder shall examine all documents, shall visit the site(s) prior to submitting proposal, record their own investigations, and shall inform themselves of all conditions under which the Work is to be performed at the site(s) of the Work, including the structure of the ground, the obstacles that may be encountered, and all of the conditions of the documents, including superintendence of the Work, requirements of temporary environmental controls, the time of completion, list of Subcontractors, and all other relevant matters that may affect the Work or the proposal process.

B. Verify cable lengths comply with published standards.

C. Notify Owner/Consultant of installation that would exceed maximum lengths prior to installation of cable.

D. Contactor shall consult with Owner/Consultant regarding alternative routing or location of cable.

E. Do not proceed until unsatisfactory conditions have been corrected.

F. Failure to make the examination shall not result in any Change Order requests.

G. The Bidder shall base the proposal on the site(s) examination, materials complying with the plans and specifications and shall list all materials where the proposal form requires.

H. The commencement of work by the Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to the Owner/Consultant prior to commencement.

I. If the Contractor observes, during preliminary examinations or subsequent work, existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, the Contractor shall report these to the Owner/Consultant in a timely manner.

3.6 Spare Parts

A. Licenses

B. Cameras

C. Card Readers

3.7 Installation Requirements

A. Refer to Section 27 00 00 for additional requirements.

B. Contractor shall furnish and install all cables, connectors, and equipment as shown on Drawings and as specified herein.

C. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.

D. Beginning installation means Contractor accepts existing conditions.

E. The Contractor shall be responsible for identifying and reporting to the General Contractor any existing damage to walls, flooring, tiles, and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation of cable, raceway, or other hardware shall be repaired by the Contractor.

F. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor-damaged ceiling tiles, floor, and carpet shall to be replaced to match color, size, style, and texture.

G. Where unacceptable conditions are found, the Contractor shall bring this to the attention of the construction supervisor immediately. A written resolution will follow to determine the appropriate action to be taken.

H. All wiring shall be run "free-air," in conduit, in a secured plastic raceway or in modular furniture as designated on the Drawings. All cable shall be free of tension at both ends. PLENUM rated cable shall be used in areas used for air handling.

I. Avoid abrasion and other damage to cables during installation.

J. The cable system will be tested and documented upon completion of the installation as defined in the section below.

K. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by manufacturers or as indicated in their published literature, unless specifically noted herein to the contrary.

3.8 Cooperation

A. The Contractor shall cooperate with Consultant's and Owner's personnel in locating work in a proper manner.

B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

3.9 Commissioning Submittals

A. Provide the following to the Owner no later than 30 days prior to system commissioning/programming.

1. Commissioning Test Plan and Check-Off List: Specified elsewhere in this document.

2. Software: One set of fully functional software in manufacturer's original media packaging, temporarily licensed for a 30-day evaluation period.

3. Web-based Training: Access to web-based training modules.

3.10 Commissioning

A. Provide programming and commissioning for each system as described in individual sections below.

B. This Contractor shall develop and submit a plan for coordination of settings and programming issues with the Consultant and Owner no later than 30 days prior to performing programming and commissioning.

C. The security Contractor is required to place entire system into full and proper operation as designed and specified.

D. Verify that all hardware components are properly installed, connected, communicating, and operating correctly.

E. Verify that all system software is installed, configured, and complies with specified functional requirements.

F. Perform final acceptance testing in the presence of Owner's representative, executing a point-by-point inspection against a documented test plan that demonstrates compliance with system requirements as designed and specified.

1. Submit documented test plan to Owner at least 14 days in advance of acceptance test, inspection, and check-off.

2. Conduct final acceptance tests in presence of Owner's representative, verifying that each device point and sequence is operating correctly and properly reporting back to control panel and control center.

3. Acceptance by Owner is contingent on successful completion of check-off; if check-off is not completed due to additional work required, re-schedule and perform complete check-off until complete in one pass, unless portions of system can be verified as not adversely affected by additional work.

4. The system shall not be considered accepted until all acceptance test items have been successfully checked-off. Beneficial use of part or all of the system shall not be considered as acceptance.

3.11 Operation and Maintenance Manuals

A. Part One: Notwithstanding requirements specified elsewhere, submit the following labeled as the "Operating and Maintenance Manual" within thirty (30) days after Final Acceptance of the Installation:

1. Record Drawings: Submit two (2) copies of revised versions of drawings as submitted in the "Shop and Field" and "Equipment Wiring Diagrams" Submittals showing actual device locations, conduit routing, wiring and relationships as they were constructed. Include nomenclature showing as-built wire designations and colors. Drawings shall include room numbers coinciding with Owner space planning numbering. Drawings shall be submitted in electronic editable AutoCAD 2010 files, in ".dwg" format, on CD or DVD disks.

2. Manuals: Submit two (2) copies of each of the following materials in bound manuals, or electronic PDF copies, with labeled dividers:

a. A final Bill of Material for each system

b. Equipment Instruction Manuals: Complete, project specific comprehensive instructions for the operation of devices and equipment provided as part of this work.

c. Manufacturers Instruction Manuals: Specification sheets, brochures, Operation Manuals and service sheets published by the manufacturers of the components, devices and equipment provided.

d. Include information for testing, repair, troubleshooting, assembly, disassembly and recommended maintenance intervals.

e. Provide a replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.

f. Performance, Test and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.

g. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturer's Warranty Registration papers as described herein.

B. Part Two: Within fourteen (14) days of receipt of Consultant reviewed Operating and Maintenance Manual (Phase One), submit three (3) electronic copies in AutoCAD 2010 editable .dwg format of the reviewed Record Drawings and three (3) copies of the reviewed Operating and Maintenance Manuals to the Owner, on CD or DVD disks.

1. Within each equipment enclosure and/or terminal cabinet, the Contractor shall place a Single Line drawing of the system(s) and the respective Terminal Cabinet Wiring Diagram in a clear plastic sleeve permanently attached to the inside cover of the terminal cabinet.

2. In each equipment enclosure the Contractor shall place a drawing providing device locations served by the equipment within the enclosure with identification that is identical to the wiring tags and with the software description of each point.

3. The Contractor shall provide to the Owner one (1) copy of new administration and user software, including required graphical maps, on CD or DVD disks.

C. Sufficient information, (detailed schematics of subsystems, assemblies and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.

3.12 Closeout Procedures

A. Notification: Contractor shall provide written notification to Architect/Consultant and Owner when Contractor is satisfied that the work has been completed and is ready for inspection.

B. Closeout Submittals: Contractor shall provide closeout documentation to the Architect/Consultant. The Architect/Consultant shall receive the closeout submittals no less than 72 hours prior to the scheduled inspection time.

C. Inspection: Contractor shall be present for the inspection by the Architect/Consultant. Contractor shall supply all testing equipment needed to verify compliance with the specifications found in Bid package.

D. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in the Bid package, and/or unacceptable to the Architect/Consultant shall be documented by the Architect/Consultant and provided to Contractor to rectify.

E. Re-Inspection: If a re-inspection is necessary, the costs of the Architect/Consultant's additional travel, hours, and expenses may be deducted by the Owner from the contract amount due Contractor.

F. Punch List Approval: The punch list shall be considered complete only after having been signed by the Owner and Architect/Consultant.

G. The system has successfully completed a 30-day performance period.

H. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by the Owner and Architect/Consultant, including punch list(s) and/or re-inspection(s).

3.13 Service Contract

A. The service contract shall cover equipment and software related to this contract, and shall provide for the following parts and services, without additional cost to the Owner:

1. Bi-yearly inspections, preventative maintenance and testing of equipment and components in Year One of the warranty period.

2. Annual inspections, preventive maintenance, and testing of equipment and components in Years Two and above of the warranty period.

3. Regular Service, Emergency Service, and Call-Back Service

4. Labor and Repairs

5. Equipment, and Materials and transportation cost.

B. Response Time: Response time for service calls.

1. Emergency service calls where system is not responding to staff directed commands through the computer systems shall be within 2 hours to the project site.

2. Emergency service calls where controllers are not reporting shall be within 2 hours to the project site.

3. Normal service calls for device malfunctions shall be within 24 hours during normal working hours to the site.

C. Repair Time: Contractor shall stock parts in sufficient quantities such that repair or replacement shall be guaranteed within 12-hours. Temporary replacements within this time period shall be acceptable, provided temporary replacements do not compromise system functionality, and provided permanent replacement is achieved within 72 hours. Contractor may contact Owner representative for use of Owner supplied spare parts where delay of system repair will have negative impact on system performance.

D. Commencement: The warranty begins at the time of issuance of the statement of "Final Acceptance of the Installation" by the Owner.

E. Transferability: The warranty shall be transferable to any person or persons at the discretion of the Owner.

F. Transmittal: A copy of this Warranty shall be delivered to, and signed for by the Owner's representative whose primary responsibility is the operation and care of these systems. A copy of the signed Warranty document shall be delivered for review as part of the Final Submittals.

G. Registration: Register Warranty papers for all equipment and software in the name of the Owner. Furnish reproductions of all equipment Warranty papers to the Owner with the Final Submittals.

H. Subcontracting: Warranty service work may not be subcontracted except with specific permission and approval by the Owner.

I. Resolution of Conflicts

1. The Owner retains the right to resolve unsatisfactory warranty service performance at any time by declaring the work unsatisfactory, stating specific areas of dissatisfaction in writing.

2. If the Contractor or his approved Subcontractor does not resolve such stated areas of dissatisfaction within thirty (30) days, the Owner may appoint any alternative service agency or person to fulfill the terms of the Warranty; the cost of which shall be borne by the Contractor. This action may be taken repeatedly until the Owner is satisfied that Warranty service performance is satisfactory. Satisfactory resolution of a malfunction shall be considered adequate when the device, equipment, system or component which is chronically malfunctioning is brought into compliance with the standards of performance as contained herein and published by the manufacturers of the equipment installed.

End of Section

27 62 00 – ELECTRONIC ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 Scope

A. Refer to Section 27 00 00 for additional project scope information.

B. This specification section covers the furnishing and installation of a new and complete enterprise-wide, low-voltage, Electronic Access Control System (EACS).

C. Contractor shall furnish and install access control hardware devices, mounting brackets, power supplies, switches, controls, consoles and other components of the system as shown and specified.

D. Contractor shall furnish and install access control related software to allow this system expansion. Software includes required license addition for access control readers and electrified portals, workstations and required physical security system Integration.

E. Furnish and install outlets, junction boxes, conduit, connectors, wiring, and other accessories necessary to complete the system installation. Requirements shall be in accordance with Division 26 00 00, Electrical.

1.2 Precedence

A. Obtain, read and comply with General Conditions and applicable sub-sections of the contract specifications. Where a discrepancy may exist between any applicable sub-section and directions as contained herein, this section shall govern.

1.3 Related Work

A. Division 08 - Door Hardware

B. Division 14 - General Elevator Requirements

C. Section 27 00 00 – General Technology Requirements

D. Section 27 05 00 – Communications General Requirements

E. Section 27 05 23 – Pathways for Technology Systems

F. Section 27 05 26 – Grounding and Bonding for Technology Systems

G. Section 27 11 00 – Communications Equipment Rooms

H. Section 27 15 00 – Communications Horizontal Cabling

I. Section 27 16 00 – Communications Connecting Cords

J. Section 27 18 00 – Communications Labeling and Identification

K. Section 27 51 00 – Distributed Communications Systems

L. Section 27 60 00 – Physical Security General Requirements

M. Section 27 64 00 – Video Surveillance System

1.4 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 and 27 60 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.
2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.
3. Execution: Coordination, testing, training, warranty, and cable management.

1.5 Pre-Construction Submittals

A. The Contractor shall submit the access control hardware layouts which includes the number of controllers, sub-panels and other associated devices per location.

B. The Contractor shall submit full power calculations which includes the anticipated power loads, number and type of power supplies including all power supply boards, number of 120VAC circuits required, battery backup including the quantities of batteries to meet requirements, PoE loads, fire alarm connection requirements, etc.

C. Refer to Section 27 00 00 and 27 62 00 for additional requirements.

1.6 Pre-installation Procedures

A. For existing facilities or retrofit projects, the Contractor shall assign all applicable electronics IP addresses and pre-build out all the enclosures including the interconnects within the enclosure prior to being delivered to the project or installed.

B. Refer to section 27 00 00 for additional requirements.

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 Electronic Access Control Hardware

A. The Access Control Panel (ACP) is used as the subcomponent to the security management system for the purpose of initiating all decision-making criteria as it relates to the cardholders, readers, and associated hardware connected. Decisions are made by the ACP and uploaded to the host computer as historical events.

B. The ACP shall be listed for Underwriters Laboratory (UL):

1. UL294 (Access Control System)

C. Provide an access control system based off of Mercury Security open platform hardware and interface modules. The panels shall:

1. Operate without the need for the host to be on-line. No decisions shall be dependent on the host.
2. Support on-board 10/100 Ethernet communications to the host as primary communication.
3. Include a request-to-exit and door status contact input for each reader without the need for additional modules for future use.
4. Detect “forced entry” and “door left open.” A separate action is required for each.
5. Allow mapping of readers to any output address within the same controller.
6. Support at least 50 user-selected holidays.

7. Allow all unused door logic, such as door strike relays, request-to-exit inputs, and door status inputs to be assigned as general-purpose points.
8. Support optional modules for additional customization of inputs and outputs.
9. Wireless reader support.
10. Elevator support.
11. Support a minimum of 5,060 alarm input points.
12. Support a minimum of 5,060 relay output points.
13. Maintain historical information for a minimum of three (3) months without AC power.
14. Automatically adjust for daylight savings time and leap year.
15. Support a variety of reader technologies.
16. Support for OSDP and OSDP SC (Secure Channel).
17. Support the following card/reader technologies as a minimum:
    a. Magnetic Stripe
    b. 125KHz Proximity cards
    c. 13.56Mhz Smart Cards and technologies
    d. Biometrics
    e. Wiegand
    f. Vehicle Identification
    g. Support multiple technologies simultaneously.
    h. Support for HID 37-bit card formats.
    i. Support for HID iClass SE and Seos technologies.
    j. Support for NXP MiFare DESFire EV1
18. Maintain the expiration date for each cardholder. Once the date is reached, the card will automatically be disabled. No access shall be authorized.
19. Maintain three (3) access times for each door location: Standard, Long, and Egress.
20. Have the ability to maintain an automatic door unlock during specific hours and days.
21. Support a minimum of (2) “levels” of Anti-Passback: Global and Area.
22. Panels shall use Mercury Security LP controllers with Series-3 MR interface panels. Contractor shall provide adequate number of access control panels, controllers, door interface panels and I/O panels for a complete turnkey system to support all components as indicated on project drawings. Basis of design is LP1502 controllers, MR52 interface panels and MR16IN/OUT I/O panels. Single door controllers shall only be used when specifically specified or approved by the consultant.

2.3 System Software

A. Operating System Requirements: Shall operate in conjunction with and be compatible with Microsoft Windows Server 2016 operating systems.

B. Support for Microsoft Active Directory (LDAP).

1. Provide all licenses and integration required for LDAP integration.

C. Support for virtualization.

1. System shall support VMware and Microsoft Hyper V virtualization.
2. The Contractor shall provide the Owner with server requirements.

D. Software shall include:

1. Graphical user interface to show pull-down menus and a menu tree format.
2. Password-protected operator login and access.

E. Access Control Application Software: Shall provide interface between the ACS Host Workstation, IP based Reader-Controllers, inputs, and outputs in order to monitor sensors operate displays, report alarms, generate reports and provide all other system functions as follows:

1. Overall Access Control System Parameters:
    a. Number of access control readers per system: Unlimited
    b. Number of client work stations per system: Unlimited
    c. Number of cardholders: 64,000 per reader stand-alone mode, unlimited in network mode.
    d. Number of credentials per cardholders: Unlimited
    e. Number of cardholder groups: Unlimited
    f. Number of system inputs: Unlimited
    g. Number of system outputs: Unlimited
    h. Reader Inputs: Door sense, request to exit, auxiliary, optical tamper, RS-232
    i. Reader Outputs: (2) outputs; TTL1 and TTL2
2. Access Control Software Functions: The system software shall provide for the following features and functions:
    a. Door Programming Functions
        i. Extended open alarms Individual Extended open timers per door.
        ii. Personal Identification Number (PIN) Codes – Up to 9 digits.
        iii. Device Support: Supports selected serial RS-232 and Wiegand devices.
        iv. Number of Door Groups: Unlimited
    b. Shifts
        i. Number of shifts: Unlimited
        ii. Interval assignments: Any day of the week.
    c. Permissions
        i. Number of Permissions: Unlimited
    d. Holidays: The software shall provide for an unlimited number of holidays.

e. Door Control: The software shall provide the following types of area control functions:

   i. Door control based on dual-authentication rules.

   ii. Support requiring credentials belonging to two people

   iii. Support requiring two credentials belong to same person

   iv. Cardholder use limits

   v. Elapsed Time based

   vi. Number of usage based

   vii. Configurable individual door strike times.

   viii. Configurable extended individual door hold open times.

f. Elevator Control: The software shall provide elevator control for an unlimited number of floors.

g. System Graphical Tree: The software shall provide for graphical tree displays of the configured field hardware.

h. Alarm and Event Logging: The software shall provide for logging of all system alarms and events chronologically including time and date stamp.

i. System Scheduling: The system shall provide for scheduling of events including:

   i. Open Door, Open Door Group

   ii. Deactivate Badges

j. Help Documentation: The software shall include complete documentation on CD.

k. Alarm attributes: The software shall provide for programming of the following alarm and monitoring attributes:

   i. Display of alarm events at the ACS Host workstation, or support networked workstation.

   ii. Require the reader-controller, which generated the alarm to be restored to its normal state before the alarm is cleared.

   iii. Require acknowledgment of an alarm to clear the alarm.

   iv. Support auto-clearing of network related communication alarms.

   v. Trigger a programmed system actions(s) when the alarm is acknowledged.

   vi. Require a User Logon for Acknowledgment.

l. Programming Downloads: The software shall provide for downloading of programming from the ACS Host to the Reader-controller-controllers as follows:

   i. Credential holders and authorized time zones

   ii. Time zones.

   iii. Alarm configurations.

   iv. Latch intervals.

   v. TTL output on REX, Tamper, Unauthorized.

   vi. Beep on events (REX, Tamper, Reject)

   vii. Complete database download of 10,000 cardholder records in less than 15 minutes with system continuing to operate normally during this time.

m. Reader-controller Programming Options: Provide the following minimum reader-controller programming functions:

i. Request to exit and door position switch: Provide programming for independent supervision of request to exit and door position switch.

ii. Manual activation of outputs: Provide for configurable activation of outputs from a credential presentation.

iii. User definable door strike time: Provide user definable/ programmable door strike functionality for each reader-controller.

iv. In/ out Reader-controller configuration: Reader-controller programmed as either an in reader or out reader for recording of time in and time out data.

v. Program use Limits: Limiting the number of times that cardholders may use their credential to gain access at the Reader-controller.

vi. Input/output linking: Provide programming for linking of reader outputs with inputs.

3. ACS Host Software Functions: The system ACS Host software shall provide for the following features and functions:

a. Device Status Monitoring

i. Alarm Status Indication: Provide real time status display that indicates the current status of all devices in the device tree.

ii. Reader-controller status: Provide display of Reader-controllers that are off line.

b. Device Group Programming

i. Reader-controller Groups: Provide for programming of Reader-controller groups.

ii. Input Groups: Provide for programming of input groups.

iii. Output Groups: Provide for programming of output groups.

c. Trace

i. Historical Trace: Provide for historical trace on any Reader-controller or cardholder.

d. Test Utilities: Provide system test utilities to allow for testing of the following functions:

i. Alarm inputs status.

ii. Output operations.

iii. Credential Presentations.

iv. LED and buzzer operations

e. Real-Time Graphical Maps: Provide graphical maps that display reader-controller status and allow for manual operation of the reader-controller.

i. Map Device Icons: Icons shall dynamically change to reflect the current state of the devices.

f. Map Formats: Support import of maps to include the following file formats:

i. JPEG (.jpg)

ii. Windows Metafile (.wmf)

iii. Windows Bitmap (.bmp)

g. Web- Browser Support

i. Support commonly used ACS functions from a standard workstation internet browser

ii. Support commonly used ACS functions from a standard mobile phone internet browser

4. Credential Management Software Functions: The system credential management software shall provide for the following features and functions:

a. Modification of cardholder records: Add, Modify and Delete records based upon permissions.

b. Access and Credential Management: Provide for the following credential management functions:

i. Assignment of single or multiple active badges.

ii. Programming personnel groups.

iii. Programming of group access permissions.

iv. Programming of individual access permissions

c. Badge Design: Provide badge design software that is integral to the access control source code with the following badge layout tools:

i. Complete Badge design and Layout.

ii. Image Import.

ID Printers: Provide support for industry standard printers and Microsoft Certified Windows printer drivers.

F. Manufacturer:

1. Panasonic (Video Insight) MonitorCast

2. Open Options DNA Fusion

3. Or pre-approved equal

2.4 ACS Client Software

A. Logging into the client software shall be done via Microsoft Active directory and enables features based on user roles and privileges.

B. The look and feel of the interface shall be customizable on a per user basis and enabled on log-in.

C. The software shall include a reporting interface to view historical events based on activity. The user shall be able to perform actions such as generating and printing a report and troubleshooting a specific event from the reporting view. The user shall be able view audit trails that show a history of user and administrator changes.

D. The software shall support graphical maps with multiple hierarchies to facilitate navigation within and between various sites and buildings. The Contractor shall set up these maps to include all cameras and integrated devices like video surveillance, access control, intercom and intrusion detection.

E. The software shall support the following additional minimum capabilities:

1. Monitoring the events from a live security system.

2. Monitoring and acknowledging alarms.

3. Creating and editing incidents and generating incident reports.

4. Executing actions from a dynamic graphical map and floor plan.

5. Management and execution of hot actions and macros.

6. Customizable display tiles with drag and drop capabilities.

F. The Contractor shall provide, install and configure client software on the following computers. The Contractor shall coordinate with the Owners to determine privileges. The Contractor shall provide the Owner with recommended workstation/laptop performance levels early in the project so they may evaluate if hardware updates are required to their existing workstations.

1. Provide pricing for up to ten (10) district computers

G. The system shall be capable of a minimum of three (3) concurrent users.

2.5 ACS Web Client

A. The web client shall be a true thin client with no download required other than web browser plug-ins.

B. The Contractor shall provide any mobile web servers and licenses required to support this functionality.

C. The web client shall support the latest versions of the following browsers:

1. Microsoft Internet Explorer

2. Google Chrome

3. Mozilla Firefox

4. Apple Safari

D. The web client shall support Microsoft Active Directory integration.

2.6 Mapping Software

A. The ACS software shall be provided with native integrated mapping software.

B. The mapping software shall be compatible with PDF, JPEG and PNG.

C. The mapping software shall be licensed to use Microsoft Bing maps, Google Maps, Open Street Maps or similar.

D. The Contractor shall provide a satellite level screen shot map showing exterior devices. These maps shall include drill down links to access the building floor plans where all interior and exterior devices are shown. The overview satellite map shall show alarms signifying there is an alarm in the building to draw attention quickly.

E. The Contractor shall be responsible to provide all the labor to setup these maps and place all the devices.

F. The Contractor shall get sign-off from the Owner and Consultant on the finished maps.

G. The Contractor shall obtain the building plans from the Consultant for their use.

2.7 Electronic Access Control Server

A. The Contractor shall coordinate with the Owner to install any required antivirus or other software on the servers before it is connected to the network. The Contractor shall also provide the Owner with any required antivirus on-access scanning exclusions for files/folders/processes.

B. The physical servers shall meet the minimum following requirements:

1. The physical servers shall be rack mountable and provided with all accessories to properly and securely mount to a rack. If the server will be mounted to a 2-post rack the contractor shall provide with a 4-post to 2-post conversion kit. Not applicable for virtual servers.
2. The servers shall be provided with a 5-year warranty.
3. The servers shall be an enterprise grade physical server with the minimum following specifications:
    a. Intel Xeon processor(s) E5 series, latest generation.
    b. 16gb Registered ECC memory
    c. Multiple SSD hard drives in a RAID 1 configuration.
    d. Quad NIC ports in a dual teamed configuration.
    e. Dual power supplies.
    f. Windows Server Standard 2016 operating system.
    g. Workstations or Computers are forbidden to be used.
    h. Manufacturer:
        i. BCDVideo Enterprise 1U 4-Bay Rackmount Access Control Server
        ii. Or approved equal, Contractor shall follow ACS manufacturers best practices
4. The primary ACS Server shall be a standalone physical server.

2.8 Contactless Smart Card Readers

A. Utilize Wiegand communication or OSDP where required or capable.

B. 13.56MHz only readers

1. Credentials:
    a. Operating Frequency: 13.56 MHz (ISO 15693, 14443A & 14443B)
    b. Contactless smart card reader shall implement the following high security 13.56 MHz applications out-of-box.
        i. Secure Identity Object on HID iCLASS SE
    c. Able to read 37-bit card format.
    d. Able to read NFC
    e. Able to read Bluetooth
2. Integrated keypad.
3. OSDP support.
4. Operating voltage range: 5-16 VDC
5. Current draw: 65mA average and 200mA peak @ 12VDC.
6. Color: Black
7. IP 55 exterior rated.
8. With attached pigtail
9. Typical read range for model R15 of 3.6” with card and 1.6” with fob

10. Typical read range for model R40 of 5.2” with card and 2.8” with fob
11. Provide adapter plate to mount on a single-gang mud ring as required.
12. Firmware upgradable via pre-programmed cards.
13. Provide the ability to transmit an alarm signal via an integrated optical tamper switch if an attempt is made to remove the reader.
14. An audio beeper and RGB light bar shall provide various tone and light sequences to signify: access granted, access denied, power up, and diagnostics.
15. Card readers shall be HID iCLASS SE R40 for standard applications and HID iCLASS SE R15 for mullion applications.
16. No non HID iCLASS SE substitutions.
17. Contractor shall register credentials and readers with HID Corporate 1000

2.9 Surge Protection for Wiegand Communication

A. The Contractor shall provide a surge protector for all exterior card readers not directly attached to a building which would include any pedestal mounted reader, gate reader or any other exposed reader potentially prone to surges.

B. Mount unit outside of the access control/power supply panels. Provide with appropriate mounting and enclosures as required.

C. There shall be a minimum of a 36” shielded cable from the surge protector to the device to allow for adequate clamping time.

D. When protector is mounted in interior, dry or weather sealed enclosure:

1. Nominal voltage rating of 12V AC/DC. Provide correct module per required voltage level if different from 12V.
2. 20,000A surge current rating.
3. Protects 2-pair per module.
4. Accepts up to 10AWG cable
5. Connect directly to ground.
6. UL 497B listed
7. Provide quantity of modules as required for the application.
8. Provide base mounting plate as required for the application.
9. Manufacturer:
    a. Ditek DTK-2MB Mounting Base
    b. (2) Ditek DTK-2MHLP12B Surge Modules
    c. Or approved equal

2.10 Surge Protection for Low Voltage AC/DC power

A. The Contractor shall provide a surge protector for all exterior devices being supplied by low voltage power. This does not include devices directly connected to a building where the risks of surges are negligible.

B. There shall be a minimum of a 36" shielded cable from the surge protector to the device to allow for adequate clamping time.

C. When protector is mounted in interior, dry or weather sealed enclosure:

1. Nominal voltage rating of 24V AC/DC. Provide correct module per required voltage level if different from 24V.
2. 20,000A surge current rating.
3. Protects 2-pair per module.
4. Accepts up to 10AWG cable
5. Connect directly to ground.
6. UL 497B listed
7. Provide quantity of modules as required for the application.
8. Provide base mounting plate as required for the application.
9. Manufacturer:
    a. Ditek DTK-2MB Mounting Base
    b. Ditek DTK-2MHLP24B Surge Module
    c. Or approved equal

2.11 Surge Protection for 120 VAC power

A. The Contractor shall provide a surge protector for all 120VAC supplied panels and enclosure when there is a critical risk of surges. This does not include interior panels which only serve interior devices or devices connected directly to a building where the risks of surges are negligible.

B. There shall be a minimum of a 36" of cable from the surge protector to the load to allow for adequate clamping time.

C. When the protector is mount in an interior or exterior location:

1. Nominal voltage rating of 120VAC, single-phase, 20A continuous load.
2. Series connected.
3. 54,000 A surge current rating.
4. 35db of EMI/RFI filtering.
5. UL 1449 Type 2 SPD listed
6. UL 1289 EMI/RFI Noise Filtering listed.
7. LED indicator.
8. Form C dry contacts for monitoring.
9. Include with NEMA 4X enclosure.
10. Maintain a minimum of 3' of cable from the surge protector to the load.
11. Manufacturer:
    a. Ditek DTK-TSS4D
    b. Or approved equal

2.12 Power Supplies and Access Control Enclosures

A. Provide a power supply/chargers and sub-assemblies to power various access controller boards, locking hardware and other access control or security system components. The Contractor shall select the appropriate enclosure, power supply and sub-assemblies for each application. The Contractor shall include network monitoring modules for all power supplies.

B. Enclosures

1. Shall be capable of accommodating power supplies, sub-assemblies and other manufactures access control controller boards when required.
2. Wall mountable.
3. Include a cam-lock and tamper switch.
4. Trove 2 enclosures when housing access control electronics.
5. eFlow or Maximal enclosures when only power supply components will be within the enclosure.

C. Power Supplies

1. 115 VAC input
2. 12VDC or 24VDC selectable outputs at:
    a. 4 amp continuous power @ 12VDC or 24VDC.
    b. 6 amp continuous power @ 12VDC or 24VDC.
    c. 10 amp continuous power @ 24VDC.
3. High capacity battery charging circuit.
    a. Provide adequate battery backup as required by Authority Having Jurisdiction (AHJ) or a minimum of 4-hours.
4. Form “C” supervision contacts for AC Low, AC Fail, and battery presence.
5. Supervised Fire Disconnect.
6. Low power Disconnect.
7. Class 2 aux. output.
8. UL 294 listed sub-assembly for access control.

D. Sub-Assemblies

1. The Contractor shall provide all sub-assemblies to meet the project requirements
2. Access Control Module
    a. Independently controlled fused protected outputs:
        i. Fail-Safe and/or Fail-Secure power outputs.
        ii. Dry form “C” 5 amp rated relay outputs (fused).
        iii. Any combination of the above
3. Access Control System trigger inputs:
    a. Normally open (NO) inputs.
    b. Open collector sink inputs.

c. Any combination of the above.

4. Fire Alarm Disconnect:
   a. Individually selectable for any or all outputs.
   b. Latching or non-latch input FACP disconnect.
   c. Normally open (NO), normally closed (NC) dry contact or polarity reversal from FACP signaling circuit trigger input.
   d. LED indicates that the Fire Alarm Disconnect has been activated.
   e. Form “C” relay output for auxiliary reporting.
5. Multi-Output Power Distribution Module
   a. Single input distributed over eight (8) outputs.
   b. Fused protected outputs.
   c. Output terminals shall accommodate up to 12AWG wires.
6. Multi-Output Power Distribution Module with Dual Inputs
   a. Two (2) inputs distributed over eight (8) outputs.
   b. Outputs shall be configurable by input.
   c. Fused protected outputs.
   d. Output terminals shall accommodate up to 12AWG wires.
7. Network Communication Modules
   a. Power Supply Network Interface
      i. Interface for up to two (2) eFlow power supply/chargers.
      ii. Two (2) Network controlled From “C” relays.
      iii. Event timers.
   b. Network Power Distribution Module
      i. Two (2) inputs distributed over eight (8) outputs.
      ii. Outputs shall be configurable by input.
      iii. Fused protected outputs.
      iv. Emergency disconnect interface by output.
      v. Selectable battery back-up by output.
      vi. Output terminals shall accommodate up to 12AWG wires.
   c. Common monitoring features
      i. Network interface via LAN/WAN.
      ii. Centralized dashboard for monitoring all power supplies. Provide appropriate hardware/software required.
      iii. Remote reporting of status via email and/or SNMP trap messaging.
      iv. AC, low battery and battery presence monitoring.
      v. Alert messages of System Service required.
      vi. System log.

vii. On demand determination of system status.

viii. Reset of individual outputs as required for remote diagnostics.

ix. Monitor enclosure temperature.

x. Static or DHCP IP address configuration.

xi. SSL Secure Sockets Layer encryption.

8. Voltage Regulator

   a. The Contractor shall provide a voltage regulator to provide constant 5VDC or 12VDC outputs for access control boards, modules or other applicable components as well as a voltage regulator for door hardwiring or controllers requiring 12VDC.

   b. 24vdc Input.

   c. Selectable 5 or 12VDC output.

   d. Output rating of 6amp max.

   e. Stackable with both Networkable and dual input power distribution modules for space savings.

9. Power supplies and sub-assemblies shall be manufactured by Altronix or approved equal:

   a. eflow4NB - 4amp 12vdc/24vdc power supply (UL listed Sub-assembly).

   b. eFlow6NB - 6amp 12vdc/24vdc power supply (UL listed Sub-assembly).

   c. eFlow104NB - 10amp 24vdc power supply (UL listed Sub-assembly).

   d. ACM8 - Eight (8) output, fused Access Control Module (UL listed Sub-assembly).

   e. ACMS8 – Dual input, eight (8) output, fused Access Control Module (UL listed Sub-assembly).

   f. Linq2 - Network Communication Module (UL listed Sub-assembly).

   g. Linq8PD - Dual input, eight (8) output, fused Network Communication Module (UL listed Sub-assembly).

   h. PDS8 - Dual input, eight (8) output, fused power distribution module (UL listed Sub-assembly).

   i. VR6 - Voltage Regulator (UL listed Sub-assembly).

2.13 Cables

A. Provide cabling per manufacturer's recommendations and code requirements for riser rated, plenum, and non-plenum cable types.

B. UTP data cabling required will be provided, installed, terminated and tested by the Division 27 structured cabling Contractor.

C. UTP patch cables will be provided and installed by the Owner in the IDF and provided by Owner and installed by Contractor at the door. The EACS Contractor shall provide the Owner a list of patch cable lengths at the door side.

D. Cables for electronic access controlled doors shall be a composite bundled cable and include the following cables and conductor counts:

   1. Card reader, OSDP – 3 twisted pairs, 22 awg shielded.

   2. Card reader, Wiegand – 6 conductor, 22 awg shielded.

   3. Lock power – 4 conductor, 18 awg unshielded.

4. Door contact – 2 conductor, 22 awg unshielded
5. Request to exit and/or latch detection/spare – 4 conductor, 22 awg unshielded

E. Manufacturer:

1. Belden (OSDP) #658AFJ
2. Belden (Wiegand) #658AFS
3. General Cable (Wiegand) #4EPL1S
4. Superior Essex (Wiegand) #AC-A1x-68
5. Or approved equal

F. Cables for RS-485 shall be 24-AWG, 2-pair with 100% coverage aluminum foil shield and 90% coverage outer tinned copper braid shield.

1. Manufacturer:
   a. Belden #9843
   b. Or approved equal

2.14 Door Contacts/Door Position Switches (DC)

A. The Security Contractor shall be responsible for the connection of all door position devices to the access control system. Door position devices shall be integral to the door hardware whenever possible. The Contractor shall refer to the door hardware schedule and coordinate with the door hardware Contractor on locations and requirements.

B. Sealed and potted magnetic reed switch in contact housing.

C. Provide color that matches door as close as possible.

D. Provide recessed switch whenever possible.

E. Armored whip for surface mount contacts.

F. Provide UTC Interlogix 1078 Series for recessed applications.

1. Or approved equal.

G. Provide UTC Interlogix 2500 Series for surface mount applications.

1. Or approved equal.

H. Provide UTC Interlogix 2200 Series for overhead door applications.

1. Or approved equal.

2.15 Request to Exit (REX) Devices

A. The Security Contractor shall be responsible for the connection of all request to exit devices integral to the door, motion based or other to the access control system. Request to Exit devices shall be integral to the door hardware whenever possible. The Contractor shall refer to the door hardware schedule and coordinate with the door hardware Contractor on locations and requirements. Motion based Request to Exit devices shall only be used when not available in the door hardware.

B. The motion based REX shall be a dual technology device with Passive Infrared (PIR) and Range-Controlled Radar (RCR) motion detector.

C. Reduces false alarms by sensing both heat and physical motion.

D. Independent adjustable beam pattern and radar depth.

E. Provide with mounting plate or wall mounting plate to mount over a single-gang backbox when required.

F. Provide color that matches door as close as possible.

G. DPDT output.

H. DC Power draw: 28mA max @ 12 VDC, 17mA max @ 24 VDC.

I. AC Power draw: 38mA max @ 12 VAC, 29mA max @ 24 VAC.

J. Dimensions: 1.76”H x 7.395”W x 1.85”D.

K. Utilize contact closure REX hardware built into the handle or crashbar whenever possible.

L. Provide UTC Interlogix RCR-REX.

1. Or approved dual technology equal.

2.16 Electrified Lock Hardware

A. Electrified lock hardware shall be specified in the Division 8 hardware specification. Refer to that specification and the Architect’s door schedule for detailed information regarding the type of hardware and requirements that will need to be connected to the access control system.

B. The Contractor shall be responsible for retrofitting existing doors with new electrified hardware for automatic release based on card/PIN, SMS software controlled momentary access, or SMS time schedule lock/unlock. Where new electrified hardware is designed to replace existing mechanical hardware, the Contractor shall be responsible for removing the existing hardware.

C. Double doors with removeable center mullion shall be provided with a quick-release connector to prevent damage to the low-voltage cable controlling the electric strikes.

2.17 Video Intercom System

A. System Description

1. Where shown on the drawings, provide a video intercom door station at the entrance and a master station at the reception desk.

2. Configure system for turnkey installation – each door station shall directly connect to the master station at that campus.

B. Approved Manufacturer:

1. Master Station – Aiphone IX-MV

2. Door Station – Aiphone IX-DVF

2.18 Door Release Buttons

A. The Contractor shall provide and install a surface mounted release button located at the locations shown at each campus to control select doors in the facility. Reference the drawings for button locations and the doors that will be controlled.

B. This same function shall also be programmed into the software allowing the receptionist to click on the door and release it.

1. Depressing the button should show in the system as an approved entry but the log should record it as being released by the receptionist not a specific individual's credential.

C. Approved Manufacturer:

1. United Security HUB-DL-L Latching hold up button with screw terminals

2.19 Lock Down / Emergency Alarm Button

A. The Contractor shall provide and install two emergency alarm buttons at the receptionist area and administrative area on each campus. Coordinate final location with Owner prior to installation.

B. When activated, the alarm button shall take any powered door(s) that are currently scheduled to be unlocked and lock them. An email and text message shall be generated to identify specific personnel that an alarm condition exists in the facility. It may also be configured to disable card access throughout the building, except for a select group of high-clearance individuals. Coordinate exact requirements with Owner.

C. Exact device type and style to be coordinated with Owner prior to approval or purchase. A selection of button options shall be presented to the Owner for review.

D. Button shall be hardwired.

E. Buttons within a single space may be wired in parallel and be programmed as a zone.

F. Manufacturer:

1. Under desk – Honeywell 269R

2. Wall/surface small pull type – Interlogix 3040-W

3. Wall push type – STI-USA Stopper Station #SS2432LD-EN

a. Blue, flush cover, latching with key to unlock, Text = LOCKDOWN. Coordinate exact text to use with Owner prior to purchase. Provide with appropriate power supply connection for illumination.

4. Or approved equals

2.20 Badges, Fobs and Credentials

A. Provide 300 smart card credentials with the following features:

1. Operating Frequency: 13.56 MHz

2. Microprocessor based

3. 8k Byte application area

4. Composite material printable on both sides.

5. Standard CR-80 size, 30 mil thick.

6. Programmable Magnetic stripe on back.

7. Sequential matching internal/external numbering.

8. 37-bit format

9. Provide with clear card holder and lanyard with clip for each card.
10. The credential shall be HID iCLASS Seos #5006PGGMN with 37-bit format number H10302.
    a. No substitutions.

2.21 Master Badge Printers and Badging Stations

A. The Contractor shall provide a color badge printer and badging station at the following locations:
   1. One location to be coordinated with Owner

B. Provide a color badge station with the minimum following features:
   1. Resin Thermal Transfer printing at 300 dpi,
   2. Dual sided printing.
   3. Single sided lamination.
   4. 16.7 million colors and 256 shades per pixel
   5. 75 cards per hour @ YMCKK with transfer and dual-sided printing
   6. Accepts standard CR-80 card sizes
   7. Accepts card thicknesses from 0.03" – 0.05"
   8. 100 card capacity input card hopper
   9. USB and Ethernet with internal print server
   10. Provide with embedded HID OMNIKEY 5127 Multiclass 13.56 MHz and 125KHz contactless smart card encoding for HID credentials.
   11. Provide with Magnetic stripe encoding.
   12. GSA FIPS-201 approved
   13. 3.2" touch screen display
   14. Three-year printer warranty and lifetime print head warranty.

C. The Contractor shall supply enough HDP film ribbons and other necessary supplies to be able to print TBD dual sided badges. Supplies shall be certified by HID Fargo.

D. The badge printer shall be an HID Fargo HDP5000 Photo ID System.
   1. Or approved equal.

E. Provide with a HD USB camera and tripod for face capture.
   1. 1080P video capture
   2. Minimum of 8 megapixel still capture
   3. Autofocus
   4. Logitech or approved equal

F. Provide with backdrop and portable stand.
   1. HID #086102 (stand)

2. HID #086100 (blue backdrop).

3. Or approved equal.

G. Provide a fully functional card reader and IP single door controller near the printer for card functionality and verification testing.

PART 3 - EXECUTION

3.1 Examination

A. Verification of Conditions: Examine doors, frames, related items, and conditions under which Work is to be performed and identify conditions detrimental to proper and or timely completion. Do not proceed until unsatisfactory conditions have been corrected.

B. Double doors with removeable center mullion shall be provided with a quick-release connector to prevent damage to the low-voltage cable controlling the electric strikes.

3.2 Mounting Heights / Dimensions

A. Comply with manufacturer's printed instructions to install hardware at specified mounting heights. Supplier shall make available templates and jigs for hardware installation. Install and protect hardware until substantial completion.

3.3 Testing

A. Refer to Section 27 00 00 for additional requirements.

B. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer’s instructions.

2. Dust, debris, solder, splatter, etc., is removed.

3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.

4. All products are neat, clean, and unmarred, and parts are securely attached.

C. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

3.4 Training

A. Refer to Section 27 00 00 for additional requirements.

B. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 6 hours of scheduled and dedicated training time in three (3) two (2) hour sessions for administration and investigation.

2. The Contractor shall provide up to 2 hours of dedicated training time for badge creation, printing and printer maintenance.

3. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.

4. Provide hands-on training with operational equipment.

5. Training shall be oriented to the specific system being installed under this contract as designed and specified.

6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.5 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.6 Installation Practices

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.

C. Contractor is responsible for providing a complete and system.

D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

3.7 Coordination

A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with sequence of operation, rule creation and coordination as requested by Owner or Consultant.

3.8 Aesthetics

A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. For any given telecom room, a horizontal and vertical alignment for all mounting hardware will be maintained to provide a symmetrical and uniform appearance to the distribution frame.

D. All surface-mounted devices shall be firmly secured level and plumb

E. All rack mount equipment shall be securely installed.

3.9 Hardware Layout

A. Hardware positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.10 Server Installation Practices

A. Verify that the manufacturer approved server hardware, OS meets the Owner’s IT standards prior to ordering.

B. Coordinate server power, cooling, and mounting requirements with Owner prior to installation.

C. Coordinate virus scan/security software requirements with Owner and manufacturer prior to installation.

3.11 Device Cabling/Wiring Installation Practices

A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.

B. This Contractor shall coordinate installation with Division 27 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.

C. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.

D. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.

E. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.

F. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

G. Cables shall not run above red iron joist.

H. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

I. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.

K. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer’s rating.

L. No splices shall be installed in any cable.

3.12 Cable Termination

A. Termination hardware (blocks and patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.13 Physical Security Systems Integration

A. The electronic access control system shall be integrated with the video surveillance system and intrusion detection system.

1. The access control/intrusion detection interface shall be via an Ethernet interface. Contact closure integration shall only be utilized if the system is existing and cannot be upgraded to Ethernet. The Contractor shall supply all necessary expansion boards if contact closure integration will be required.

2. The access control/video surveillance integration shall be via a native IP interface.

3. The video surveillance /intrusion detection interface shall be via an Ethernet interface.

B. The Contractor shall provide any and all licensing to integrate the systems together including any additional items to be added to the yearly maintenance agreement.

C. The following minimum features shall be included in the integration; the following list is not all inclusive or exhaustive. The integration shall be a turnkey solution:

1. Call up live and/or recorded video from an alarm or event.

2. Graphical maps showing camera icons.

3. “Mouse over” camera viewing through the DVR/NVR browser and graphical maps.

4. Playback controls for recorded video.

5. Camera names brought in from the VMS.

6. PTZ camera mouse control.

7. Database entries for intrusion arm/disarm events on individual keypads.

8. Database entries for intrusion alarm events.

9. Graphical map symbols for intrusion keypads tied to camera views.

10. Intrusion devices or zones tied to camera views.

11. Alarm pop-ups and events shall include instructions and a sequence of operation to deal with events on the Intrusion Detection System, Video Management System and Electronic Access Control System.

12. Time syncing via common NTP server.

D. The Contractor shall set up a meeting between the Owner, Consultant and manufacturer to determine the exact functionality of the integration before the integration starts.

3.14 ADA Power Assist Door Operator Interface

A. Certain electric locking mechanisms with card access shall be connected (hardwired) to the ADA Power Assist Door Operator pushbutton. In this scenario, card reader shall be interfaced to the ADA Door Operator pushbutton to approve activation of door motor based on card authorization or pre-programmed security schedule.

B. Door motor shall not be energized until authorized by the security system to prevent operation and eventual burn-out of the motor from hitting the button with the security system activated.

C. Contractor shall provide all necessary hardware, interfaces, and system programming.

3.15 Fire Alarm Interface

A. Certain electric locking mechanisms shall be connected (hardwired) to the building fire alarm system for fail safe release upon any fire alarm. A single low voltage/low current normally closed dry contact from the fire alarm system shall be provided by others in each room with Security Control Panels. This contact shall open on any fire alarm condition.

B. The Contractor shall provide all additional UL listed failsafe relays and power supplies as necessary to interface to this contact and unlock all of these doors.

C. The Contractor shall verify fail safe and fail secure locking requirements with the Architect, door hardware contractor/provider and the AHJ. Refer to fire alarm contractor shop drawing for fire alarm interface requirements.

3.16 Fire Stopping

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by or for This Contractor and left unused shall be sealed up by This Contractor.

C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

3.17 System Inspection

A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

3.18 Labeling

A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on Project as-built drawings.

3.19 Documentation

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 60 00. All documentation shall become the property of the Owner.

B. Documentation shall include the additional specific items detailed in the subsections below:

1. Contractor shall provide hard copy and electronic forms of the final test results.

2. Contractor shall provide a document including the following:

a. Door label/identifier

b. Location of each drop by orientation/permanent landmark in the room

c. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

3.20 Pre-Check out

A. The Contractor shall demonstrate the following to Owner during system demonstration.

1. The card readers are fully installed and functional.

3.21 Final Acceptance

A. In addition to closeout requirements in section 27 60 00, This Contractor shall demonstrate the following before final approval.

1. Owner training is complete.

2. Punch list items are complete.
3. As-built documentation is complete and submitted to Owner/Consultant.

3.22 Final Procedures

A. Perform final procedures in accordance with section 27 60 00.

End of Section

27 64 00 – VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.1 Scope

A. The Contractor shall provide a new Video Management System (VMS) with server, software, client workstations, and converters to bring the Owner's existing cameras into the new system.

B. The Contractor shall provide unit pricing to add cameras so that the Owner may elect to add however many cameras they can afford. The technology drawings identify camera locations with keynotes to indicate whether it is an existing or new location and whether the camera requires a new data cable.

C. The Category 6 cabling to each camera shall be provided by the structured cabling Contractor.

D. System installation shall include, but not be limited to, installation, programming, and configuration of system components as well as all associated software upgrades, patches, and maintenance for the first year.

E. Contractor is responsible for meeting with Owner's representative at time of camera installation to verify exact placement and view of each camera to ensure coverage area is as intended.

1.2 Unit Prices

A. Provide itemized Add pricing for providing cameras as follows:

1. One (1) interior camera with installation, mount, license, etc. to match description in this specification: $_____

2. One (1) exterior camera with installation, mount, license, etc. to match description in this specification: $_____

1.3 Precedence

A. Obtain, read and comply with General Conditions and applicable sub-sections of the contract specifications. Where a discrepancy may exist between any applicable sub-section and directions as contained herein, this section shall govern.

1.4 Related Work

A. Division 14 - General Elevator Requirements

B. Section 27 00 00 – General Technology Requirements

C. Section 27 05 00 – Communications General Requirements

D. Section 27 05 23 – Pathways for Technology Systems

E. Section 27 05 26 – Grounding and Bonding for Technology Systems

F. Section 27 11 00 – Communications Equipment Rooms

G. Section 27 15 00 – Communications Horizontal Cabling

H. Section 27 16 00 – Communications Connecting Cords

I. Section 27 18 00 – Communications Labeling and Identification

J. Section 27 51 00 – Distributed Communications Systems

K. Section 27 60 00 – Physical Security General Requirements

L. Section 27 62 00 – Electronic Access Control System

1.5 Reference

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 and 27 60 00 including but not limited to:

1. General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

2. Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

3. Execution: Coordination, testing, training, warranty, and cable management.

1.6 Mounting and Installation

A. Contractor shall provide the appropriate mounting hardware for all ceiling types and wall types where cameras shall be located. Plastic anchors are not allowed.

B. Wall mounted 180/360 degree or multi-sensor cameras shall be mounted horizontally on a wall arm, gooseneck, parapet, pendant or other similar method.

C. Exterior cameras shall be mounted on a wall arm/gooseneck.

D. Cameras mounted in droptile shall have a tile support bridge with a steel support cable connected to structure to prevent tile sagging, theft and vandalism. Utilizing toggle bolts or other screw in anchors is not allowed.

1.7 Code and Standard Requirements

A. All work and materials shall conform in every detail to the rules and requirements of the National Fire Protection Association and any other codes as required by the AHJ.

B. All materials shall be listed by UL and shall bear the UL label. If UL has no published standards for a particular item, then other national independent testing standards shall apply and such items shall bear those labels. Where UL has an applicable system listing and label, the entire system shall be so labeled.

C. Cameras shall meet the following standards:

1. MPEG-4:

a. ISO/IEC 14496-10 AVC (H.264)

2. Networking:

a. IEEE 802.3af (Power over Ethernet)

3. Network Video:

a. ONVIF Profile S or better

PART 2 - PRODUCTS

2.1 Substitutions

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 00 00.

2.2 VMS General Requirements

A. The VMS shall be a server/client model and be based on a true open architecture that shall allow for use of non-proprietary workstation and server hardware, non-proprietary network infrastructure and non-proprietary storage.

B. The VMS shall support video encoded in MPEG-4, MPEG-2, MJPEG, H.264, H.265/HEVC and Wavelet compression formats.

C. The VMS shall support audio encoded in g711 (u-law), g721, g723 or AAC compression formats.

D. The VMS shall support and be configured for multicast. Coordinate with the Owner on multicast network requirements.

E. The VMS shall be capable of supporting failover and standby functionality.

F. The VMS shall be licensed for active directory.

G. The VMS shall synchronize to a common NTP server as the cameras and other security systems.

H. The system shall log all actions on a per user basis, all alarms and notifications on a per device basis and all errors and failures on a per device basis. These logs shall have the ability to be extracted to a document that can be emailed to an administrator.

I. The system shall support custom rules and actions.

J. The VMS shall be provided with mapping features. The Contractor shall acquire drawings from the Consultant to utilize for the mapping.

K. The VMS shall fully support H.264 and H.265/HEVC Smart Coding with dynamic GOP and Dynamic Frame Rate.

L. The VMS shall support full API level integration with all cameras utilized. Integrating via ONFIV is not acceptable.

M. The VMS shall have native API level support for fisheye cameras and client side dewarping. The VMS shall not utilize the video stream to detect a fisheye camera.

N. The system shall log all actions on a per user basis, all alarms and notifications on a per device basis and all errors and failures on a per device basis. These logs shall have the ability to be extracted to a document that can be emailed to an administrator.

O. The VMS shall be provided with a 5-year software maintenance service agreement to last through the duration of the project. The Owner shall be able to receive all major and minor software updates at no additional cost for the duration of the project. At the completion of the project the Owner shall have the option to receive a final software to the latest version before the project is paid in full.

P. Manufacturer:

1. Video Insight

2. Or pre-approved equal

2.3 VMS Directory Management Software

A. The VMS shall include Microsoft Active Directory integration. The Contractor shall coordinate with the Owner on permissions, roles and integration.

B. The directory management server shall be compatible with Microsoft Windows Server Standard 2016.

C. The database server shall be compatible with Microsoft SQL Server 2014 or above.

D. The VMS Directory Management server shall be compatible with virtual environments including VMware and Microsoft Hyper-V Server.

2.4 VMS Client Software

A. Logging into the client software shall be done via Microsoft Active directory and enables features based on user roles and privileges.

B. The look and feel of the interface shall be customizable on a per user basis and enabled on log-in.

C. The software shall include a reporting interface to view historical events based on activity. The user shall be able to perform actions such as generating and printing a report and troubleshooting a specific event from the reporting view. The user shall be able view audit trails that show a history of user and administrator changes.

D. The software shall support graphical maps with multiple hierarchies to facilitate navigation within and between various sites and buildings. The Contractor shall set up these maps to include all cameras and integrated devices like access control, intercom and intrusion detection.

E. The operator shall be able to bookmark multiple cameras and create an incident report with the associated cameras and integrated devices attached. The bookmarks shall be protected from overwriting until the user manually deletes them. The bookmarks shall be ab le to be moved to a separate storage drive for long term archiving. The user shall be able to pull up a list of all bookmarks saved for easy management of them.

F. The software shall be able to export multiple video clips to a single file system with a self-contained player. These clips shall include the option to be encrypted. The self-contained player shall support multiple and selectable video tiles with the ability to digitally zoom. The user shall be able to build an incident by placing additional video clips into this file system for convenient storage.

G. The software shall support the following additional minimum capabilities:

1. Monitoring the events from a live security system.
2. Monitoring and acknowledging alarms.
3. Creating and editing incidents and generating incident reports.
4. Executing actions from a dynamic graphical map and floor plan.
5. Management and execution of hot actions and macros.
6. Customizable display tiles with drag and drop capabilities.
7. The software shall support a minimum of 6 active displays.
8. Intercom with duplex audio through integrated intercom system or camera equipped with or connected to a microphone and speaker.
9. Control of physical and virtual PTZ cameras with mouse control or PTZ joystick/keyboard control.
10. Client side dewarping of ImmerVision 360 enabled cameras with multiple view areas and virtual PTZ control.
11. Display all cameras from associated with the system and federated systems.
12. Create snapshots from live or recorded video. These snapshots shall be automatically saved to a snapshot folder.
13. Link cameras in live and recorded views for seamless tracking of a subject throughout a facility. The Contractor shall configure the links for all cameras within and outside of the facility.

2.5 VMS Web Client

A. The web client shall be a true thin client with no download required other than web browser plug-ins.

B. The Contractor shall provide any mobile web servers and licenses required to support this functionality.

C. The web client shall support the latest versions of the following browsers:

1. Microsoft Internet Explorer
2. Google Chrome
3. Mozilla Firefox
4. Apple Safari

D. The web client shall support Microsoft Active Directory integration.

E. The web client shall support the minimum following functionalities:

1. Live and recorded video playback.
2. Video export.
3. Multiple video tiles.
4. PTZ mouse controls.

2.6 Mapping Software

A. The VMS software shall be provided with native integrated mapping software.

B. The Contractor shall provide a satellite level screen shot map showing exterior devices. These maps shall include drill down links to access the building floor plans where all interior and exterior devices are shown. The overview satellite map shall show alarms signifying there is an alarm in the building to draw attention quickly to the correct building then floor plan.

C. The mapping software shall be licensed to use Microsoft Bing maps, Google Maps or similar.

D. The maps shall have links to the other levels/sections as well as the global map.

E. All cameras shall show their approximate field of view.

F. The cameras shall change state when motion is detected.

G. The floor plans shall include all access controlled door and integrated devices.

H. The Contractor shall be responsible to provide all the labor to setup these maps and place all the devices.

I. The Contractor shall get sign-off from the Owner and Consultant on the finished maps.

J. The Contractor shall obtain the building plans from the Consultant for their use.

2.7 VMS Servers

A. General Server Requirements

1. The Contractor shall coordinate with the Owner to install any required antivirus or other software on the servers before it is connected to the network. The Contractor shall also provide the Owner with any required antivirus on-access scanning exclusions for files/folders/processes.

2. The servers shall be rack mountable and provided with all accessories to properly and securely mount to a rack. If the server will be mounted to a 2-post rack the contractor shall provide with a 4-post to 2-post conversion kit.

3. The servers shall be provided with a 5-year warranty.

4. The servers shall be purpose built for surveillance, video optimized storage and management. The manufacturer shall guarantee performance with the system design at the time of purchase.

5. The servers shall be rack mountable and provided with all accessories to properly and securely mount to a rack. If the server will be mounted to a 2-post rack the contractor shall provide with a 4-post to 2-post conversion kit.

6. Workstations or PC Computers shall not be used as a server.

B. Approved manufacturer:

1. Video Insight

2. Or pre-approved equal

2.8 VMS Video Storage

A. Provide a minimum of thirty-five (35) days of storage calculated at the following resolution and rates. Provide all hardware, software and configuration needed to accomplish this.

B. Video storage shall be calculated to support all cameras shown on the technology plans, regardless of how many cameras the Owner decides to purchase (based on the unit pricing approach indicated above). The proposed system must be able to support cameras at these locations when the Owner decides to add them without the Owner having to add any associated hardware. In addition to supporting 'new' cameras at the locations shown, the system shall also be sized to support all existing cameras, including the analog ones that will receive converters as well as the few existing IP cameras.

C. Record stream using Unicast RTP/TCP

D. Pre and post record buffer of 5 seconds.

E. Provide an additional ~10% storage for additional space.

1. Interior Cameras:

a. 15 fps

b. 1 keyframe (I-Frame) per second

c. Max resolution

d. 100% recording with motion enabled for meta data.

e. VBR or framerate priority with cap appropriate to resolution and quality

f. H.264 Main Profile compression

g. Smart codec enabled at a medium setting with a dynamic GoP of up to 4 seconds.

h. No data rate cap when smart codecs are enabled.

i. Audio encoding (for cameras with microphones connected or built into them).

2. Exterior Cameras:

a. 15 fps

b. 1 keyframe (I-Frame) per second

c. Max resolution

d. 100% recording with motion enabled for meta data.

e. VBR or framerate priority with cap appropriate to resolution and quality

f. H.264 Main Profile compression

g. Smart codec enabled at a medium setting with a dynamic GoP of up to 4 seconds.

h. No data rate cap when smart codecs are enabled.

2.9 VMS Client Workstations

A. The Contractor shall provide and install workstations at the following locations:

1. Four locations, coordinate with Owner

B. The workstation shall meet the minimum following specifications:

a. Provide with (2) 24" 1920x1080 monitors.

b. Intel Core i7 quad core @3.6 GHz (min) with hyper-threading (HT) enabled (8 threads visible to Windows) with integrated GPU supporting Intel Quicksync video, latest generation. (i7-7700 as BoD)

c. A minimum of 16 GB of DDR4 2133MHz ram.

d. 10/100/1000 NIC port.

e. Dedicated Nvidia Quadro graphics card with a minimum of 2GB of dedicated GDDR5 ram, 384 CUDA Parallel-Processing Cores, (4) mini Display Port 1.4 outputs capable of simultaneous 4k outputs, HDCP 2.2 support and H.265/HEVC decoding support. (Nvidia Quadro P600 as BoD)

i. Provide adapters as required to connect to monitors.

ii. Provide quantity of video cards as required to connect to quantity of monitors.

f. (1) 256GB SSD HDDs for OS and programs.

g. (1) 1TB SATA HDD for video export storage. The Contractor shall set the software to automatically export to this drive.

h. 16x DVD+/- RW burner with software.

i. Sound card or integrated to motherboard with inputs and outputs.

j. 92% efficient power supply.

k. Windows 10 Professional x64.

l. The Contractor shall coordinate with the Owner to install anti-virus and other required software before the Contractor connects the workstation to the network. The Contractor shall provide the Owner with a list of anti-virus exclusions required for smooth performance of the workstation.

m. Mini tower configuration.

n. Provide with 5 year pro support with 24x7x365 phone support and same day hardware replacement.

o. Approved manufacturers:

i. BCDVideo

ii. Dell

iii. HP

2.10 Cameras and Devices

A. General:

1. All cameras and devices shall be time synced to the Owner's NTP server. Coordinate with the Owner to acquire the appropriate NTP address to use.

2. The contractor shall coordinate with the owner for IP addressing, network configuration, QoS and multicast network configuration.

3. The Contractor shall enable QoS on all cameras and intercoms for the video stream, audio stream, event/alarm data, management and metadata at the Owners request.

4. The system shall be configured for multicast. All cameras shall have a multicast Time To Live (TTL) setting of at least 64.

5. The Contractor shall select the appropriate mounting hardware for the situation.

6. All cameras shall be equipped with remote autofocus or autoback focus with the exception of fixed lens 180/360 degree cameras and encoded analog cameras.

7. Multi-sensor 180 and 360 cameras shall have each sensor optimally calibrated independently to the conditions.

8. All cameras shall be vandal proof and appropriate for the environment it is being installed in.

9. All cameras shall have the latest VMS recommended firmware installed and all cameras of the same model shall have matching firmware versions. The Contractor shall provide all necessary firmware upgrades to keep the Owner on the latest version throughout the duration of the project. At the completion of the project the Owner shall have the option to receive a final firmware update the latest version before the project is paid in full.

10. The contractor shall coordinate with the owner for IP addressing, network configuration and multicast network configuration.

11. All cameras regardless of manufacturer/model shall have a consistent user name and non-standard password set. This shall be documented and provided to the owner and consultant prior to inspections.

12. Cameras and devices shall not be an OEM or "white label" product. The camera or device shall be manufactured by the named manufacturer.

13. The cameras and devices firmware shall be developed and manufactured by the stated manufacturer and shall not be developed, written or OEM by a 3rd party.

14. The camera requirements below represent general performance criteria. Approved equals will have slight differences in specifications. The Owner and Consultant have complete discretion to reject approved equals that stray too far from the minimum requirements.

B. Approved Manufactures:

1. Camera Type #1 Indoor – Panasonic WV-S3531L

2. Camera Type #2 Outdoor – Panasonic WV-S2531LN

3. Camera Type #3 360 degree – Panasonic WV-SF438

2.11 Analog to IP Camera Converters/Encoders

A. Provide 4-channel video encoders to bring all existing analog CCTV cameras onto the VMS.

B. Refer to technology drawings for existing DVR locations and existing analog camera locations and counts. Contractor shall field verify all locations and requirements.

C. We anticipate the following converter locations and quantities. Contractor shall confirm counts based on plans as well as site visits and adjust as necessary. The information below is for reference only and shall not remove the Contractor's responsibility to provide the quantity and location of encoders necessary to bring all existing cameras into the new system.

1. Elementary School

a. MDF – at least (3) encoders

b. Stage AV rack – at least (1) encoder

2. Middle School

a. Computer Lab Attic – at least (4) encoders

b. Possibly one other location; there is a camera on the exterior of the cafeteria that doesn't show up on the main DVR views. Contractor shall trace this cable and determine where it terminates.

3. High School

a. Main Building – at least (7) encoders

b. Ag/Shop Bldg – at least (3) encoders

D. Video encoders shall meet the following requirements:

1. Full frame rate in all resolutions

2. Simultaneous H.264 and Motion JPEG

3. Edge storage

4. High-resolution quad view

5. PTZ support

6. Power over Ethernet

E. Provide any necessary licenses to bring the encoders into the VMS

F. Approved Manufacturer:

1. Axis P7214

2.12 Camera Management Tools

A. The Contractor shall setup on an appropriate server the manufacturer's camera management tools utilized to manage the settings, firmware and status of all installed cameras. The Contractor shall train the Owner on the use of this software.

2.13 Ethernet with Power over Ethernet (PoE) UTP Extender

A. The Contractor shall provide Ethernet with PoE UTP extenders for out-of-distance cameras or Ethernet devices.

B. Shall support IEEE 802.3af (PoE) and IEEE 802.3at (PoE+) on input and output.

C. Extends UTP up to 350 meters or greater.

D. 10Base-T or 100Base-TX, full-duplex with auto-negotiation.

E. Multicast support.

F. Mid-span extenders are forbidden.

G. Manufacturer:

1. Veracity Longspan with PoE
    a. Provide specific models as required
    b. Provide with dedicated power supply as or when required.
2. Or approved equal

2.14 Ethernet with Power over Ethernet (PoE) UTP Surge Suppressor

A. The Contractor shall provide and install a surge protector for all exterior mounted cameras. Cameras that are not attached to the building or reach above the building roof line shall have a surge protector at the camera side and interior termination side.

B. There shall be a minimum of a 36” shielded patch cable from the surge protector to the device to allow for adequate clamping time.

C. When protector is mounted in interior, dry or weather sealed enclosure:

1. Shielded RJ-45 jacks and ground stud
    a. Connect ground directly to ground bar (TMGB/TGB) or ground.
    b. Do not use shielded cable on the output.
2. Maximum supported data rate: 10,000Mb/s (10 Gigabit)
3. Supports IEEE 802.3af (PoE)
4. Max current rating of 30A per pair.
5. UL 497B listed
6. 110 punch down in and 110 punch down out.
    a. 110 punch down in and RJ-45 out may be used when output is connected directly to a switch only when approved in specific situations.
7. Manufacturer:
    a. Ditek DTK-110C6APOE
    b. Or approved equal

D. When protector is exposed to weather or moisture:

1. Shielded RJ-45 jacks and ground connection.
    a. Connected ground connection directly to ground.
    b. Do not use shielded cable on the output.
2. Outdoor-rated NEMA 4X enclosure
3. Maximum supported data rate: 1,000Mb/s (1 Gigabit)
4. Supports IEEE 802.3af, 802.3at (PoE) and PoE+ up to 144 watts per port.
5. Max current rating of 20,000A per pair.
6. UL 497B listed
7. RG-45 in and RJ-45 out.
8. Provide with appropriate mounting kit.
9. Manufacturer:
    a. Ditek DTK-MRJPOEX
    b. Or approved equal

2.15 Ethernet UTP Surge Suppressor (No PoE)

A. The Contractor shall provide and install a surge protector for all exterior mounted cameras. Cameras that are not attached to the building or reach above the building roof line shall have a surge protector at the camera side and interior termination side.

B. There shall be a minimum of a 36” shielded patch cable from the surge protector to the device to allow for adequate clamping time.

C. When protector is mounted in interior, dry or weather sealed enclosure:

1. Shielded RJ-45 jacks and ground stud
    a. Connect ground directly to ground bar (TMGB/TGB) or ground.
    b. Do not use shielded cable on the output.
2. Maximum supported data rate: 10,000Mb/s (10 Gigabit)
3. Max current rating of 100A per pair.
4. UL 497B listed
5. 110 punch down in and 110 punch down out.
    a. 110 punch down in and RJ-45 out may be used when output is connected directly to a switch only when approved in specific situations.
6. Manufacturer:
    a. Ditek DTK-110C6A
    b. Or approved equal

2.16 Surge Protection for Low Voltage AC/DC power

A. The Contractor shall provide a surge protector for all exterior devices being supplied by low voltage power. This does not include devices directly connected to a building where the risks of surges are negligible.

B. There shall be a minimum of a 36" shielded cable from the surge protector to the device to allow for adequate clamping time.

C. When protector is mounted in interior, dry or weather sealed enclosure:

1. Nominal voltage rating of 24V AC/DC. Provide correct module per required voltage level if different from 24V.
2. 20,000A surge current rating.
3. Protects 2-pair per module.
4. Accepts up to 10AWG cable
5. Connect directly to ground.
6. UL 497B listed
7. Provide quantity of modules as required for the application.
8. Provide base mounting plate as required for the application.
9. Manufacturer:
    a. Ditek DTK-2MB Mounting Base
    b. Ditek DTK-2MHLP24B Surge Module
    c. Or approved equal

2.17 Surge Protection for 120 VAC power

A. The Contractor shall provide a surge protector for all 120VAC supplied panels and enclosure when there is a critical risk of surges. This does not include interior panels which only serve interior devices or devices connected directly to a building where the risks of surges are negligible.

B. There shall be a minimum of a 36" of cable from the surge protector to the load to allow for adequate clamping time.

C. When the protector is mount in an interior or exterior location:

1. Nominal voltage rating of 120VAC, single-phase, 20A continuous load.
2. Series connected.
3. 54,000 A surge current rating.
4. 35db of EMI/RFI filtering.
5. UL 1449 Type 2 SPD listed
6. UL 1289 EMI/RFI Noise Filtering listed.
7. LED indicator.
8. Form C dry contacts for monitoring.
9. Include with NEMA 4X enclosure.

10. Maintain a minimum of 3’ of cable from the surge protector to the load.
11. Manufacturer:
    a. Ditek DTK-TSS4D
    b. Or approved equal

PART 3 - EXECUTION

3.1 Testing

A. Refer to Section 27 00 00 for additional requirements.

B. Prior to energizing or testing the system, ensure the following:

1. All products are installed in a proper and safe manner per the manufacturer’s instructions.
2. Dust, debris, solder, splatter, etc., is removed.
3. Cable is dressed, routed, and labeled; connections are consistent with regard to polarity.
4. All products are neat, clean, and unmarred, and parts are securely attached.

C. Contractor shall ensure that each device in the security system is functioning normally and in such a manner as to meet the functional and performance requirements in this specification.

3.2 Training

A. Refer to Section 27 00 00 for additional requirements.

B. Provide system operations, administration, and maintenance training by factory-trained personnel qualified to instruct.

1. Contractor shall provide up to 12 hours of scheduled and dedicated training time in three (3) four (4) hour sessions for administration and investigation.
2. Contractor shall provide up to 2 hours of scheduled and dedicated training time for maintenance including lens and dome cleaning, focusing and positioning.
3. Provide printed training materials for each trainee, including product manuals, course outline, workbook or student guides, and written examinations for certification.
4. Provide hands-on training with operational equipment.
5. Training shall be oriented to the specific system being installed under this contract as designed and specified.
6. Contractor shall provide all necessary documentation of system operating parameters prior to scheduled training sessions.

3.3 Warranty

A. Refer to Section 27 00 00 for additional requirements.

3.4 Installation Practices

A. All services provided shall be professional and conform to the highest standards for industry practices. The Owner reserves the right to halt any installation due to poor workmanship. All work shall be defect free, and the installer shall replace, at their expense, any work found to be defective.

B. The Owner reserves the right to halt any installation due to failure of Contractor to observe installation-free periods due to instructional or administrative requirements. To the maximum extent possible, the Owner will provide advance notice of such periods.

C. Contractor is responsible for providing a complete and functional video surveillance system.

D. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by the manufacturers, or as indicated in their published literature, unless specifically noted herein to the contrary.

E. Contractor shall follow these standards and approved submittals for locations of power supplies. The Owner intends to limit the number and location of power supplies to facilitate more effective long-term support and maintenance of the system.

3.5 Coordination

A. Contractor shall provide up to 8 hours (up to four, 2-hour sessions) of scheduled and dedicated coordination time to assist Owner with camera positioning and coordination as requested by Owner or Consultant.

3.6 Aesthetics

A. All cables and equipment terminating at panels frames shall be vertically straight, with no cables crossing each other, from twelve inches inside the ceiling area to the termination block.

B. All cable bundles shall be combed and bundled to accommodate individual termination block rows and panels.

C. For any given telecom room, a horizontal and vertical alignment for all mounting hardware will be maintained to provide a symmetrical and uniform appearance to the distribution frame.

D. All surface-mounted devices shall be firmly secured level and plumb

E. All rack mount equipment shall be securely installed.

3.7 Hardware Layout

A. Hardware positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.8 VMS Installation Practices

A. Verify that the manufacturer approved server hardware, OS meets the Owner's IT standards prior to ordering.

B. Coordinate server power, cooling, and mounting requirements with Owner prior to installation.

C. Coordinate virus scan/security software requirements with Owner and manufacturer prior to installation.

3.9 Device Cabling/Wiring Installation Practices

A. All external wire and cables shall be supported at least every five feet from the structure or as required to maintain not more than 12" cable sag between supports and without over tensioning the cables. Provide j-hooks as needed where cable tray or raceway is not available.

B. This Contractor shall coordinate installation with Division 27 05 00 cabling Contractor to ensure there is at least 2-inches of physical separation between security cabling and voice/data cabling throughout cable path. Voice/data cabling Contractor has first claim to cable tray.

C. All cables, regardless of length, shall be labeled within 18" of both ends with an identifier that is keyed to the door, room, or corridor number as identified.

D. All cables shall have 6-foot service loops neatly coiled in the equipment room. During initial cable rough-in, this Contractor shall have sufficient slack to route anywhere within the equipment room.

E. Cabling shall be adequately supported with Velcro wire wraps and horizontal support cable managers fastened to rack frame. Cables shall be dressed in a neat and orderly fashion. Any cabling or equipment installation that is deemed unacceptable by the Owner or Consultant shall be replaced or corrected by the Contractor at no additional cost. Plastic zip ties are not allowed.

F. All cables are to run at right angles to the structure, placed above the ceiling in halls or corridors.

G. Cables shall not run above red iron joist.

H. Contractor shall make every effort to conceal wiring and other apparatus into walls, floors, and ceilings, assuming code and good engineering practice allows and suggests.

I. Ties and straps shall be installed snugly without deforming cable insulation. Ties shall be spaced at uneven intervals not to exceed four feet. No sharp burrs shall remain where excess length of the cable tie has been cut.

J. Contractor shall notify Owner immediately if obstruction or hazard is discovered in a pathway provided by others.

K. Cable shall be stored and handled to assure that it is not stretched, kinked, crushed, or abraded in any way. Bend radiuses shall meet manufacturer specifications and/or recommendations. Cable shall not be installed in ambient temperatures or moisture conditions above or below the manufacturer's rating.

L. No splices shall be installed in any cable.

3.10 Cable Termination

A. Termination hardware (blocks and patch panels) positioning and layout shall be reviewed and approved by the Owner prior to construction. The review does not exempt Contractor from meeting any of the requirements stated in this document.

3.11 Fire Stopping

A. Fire stopping of openings between floors, fire-rated walls, and smoke-rated walls, created by others for This Contractor to pass cable through, shall be the responsibility of the This Contractor. Sealing material and application of this material shall be accomplished in such a manner that is acceptable to the local fire and building authorities having jurisdiction over this work.

B. Any openings created by or for This Contractor and left unused shall be sealed up by This Contractor.

C. This Contractor shall be responsible for creating a waterproof seal in and around any openings that This Contractor creates from the structure to the outside environment.

3.12 System Inspection

A. Contractor shall coordinate with project representative for inspection after Contractor has completed testing of entire system.

B. Contractor shall have trained Contractor representative and testing equipment on site during inspection to assist with spot verification of tests.

C. Contactor shall verify with Project Representative the precise positioning of camera aim and shall make fine adjustments as requested.

3.13 Labeling

A. Contractor shall neatly label all security devices and cabling at both ends. All labels shall be on Project as-built drawings.

3.14 Camera Installation

A. Contractor shall field verify all camera locations and positioning with Owner prior to installation.

3.15 Documentation

A. Upon completion of the installation, Contractor shall provide full documentation sets to the Consultant for approval as described in section 27 60 00. All documentation shall become the property of the Owner.

B. Documentation shall include the additional specific items detailed in the subsections below:

1. Contractor shall provide hard copy and electronic forms of the final test results.
2. Contractor shall provide a document including the following:
    a. Camera label/identifier
    b. Location of each drop by orientation/permanent landmark in the room
    c. Contractor shall provide accurate as-built Construction Drawings. The drawings are to include cable routes and device locations.

3.16 Pre-Checkout

A. The Contractor shall demonstrate the following to Owner during system demonstration.

1. The cameras are fully installed and functional.
2. Camera adjustments are complete to the Owner's satisfaction including.
    a. Aim/Zoom
    b. Focus/Back Focus
    c. Masking Zones
    d. Motion Detection Zones
    e. Pre-Sets/Tours

3.17 Final Acceptance

A. In addition to closeout requirements in section 27 60 00, This Contractor shall demonstrate the following before final approval.

1. Owner training is complete.
2. Punch list items are complete.
3. As-built documentation is complete and submitted to Owner/Consultant.

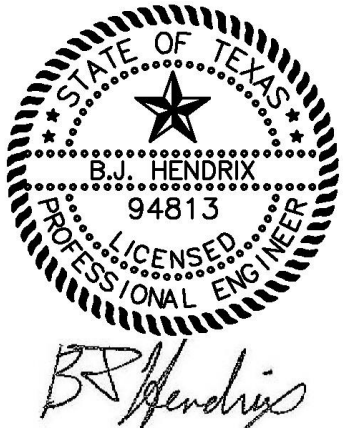
3.18 Final Procedures

A. Perform final procedures in accordance with section 27 60 00.

End of Section

MEP SECTIONS

BRADY ISD
2018 BOND
Mechanical/Electrical Specifications



04/04/2019

MEP/ENERGY CONSULTANTS

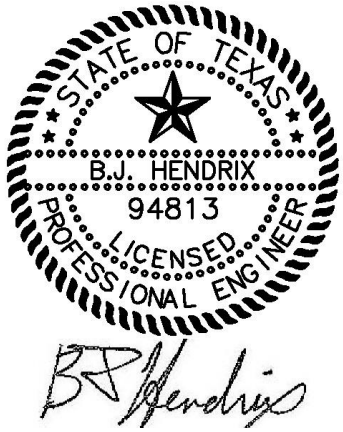
HCE HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 E. MAIN
ROUND ROCK, TX 78664
F-4095

DIVISION 20, 22 & 23
BRADY ISD – 2018 BOND
MECHANICAL SPECIFICATIONS

CONTENTS:



04/04/2019
F-4095

SECTION 20 00 00 - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work of Division 20-24 consists of providing labor, materials, products, and all operations required for the complete operating installation of all mechanical systems as shown and specified, in strict compliance with applicable drawings, specification, terms and conditions of the contract and all applicable codes and ordinances governing the installation of the various mechanical systems. Contractor shall provide all equipment and materials necessary and usually furnished in connection with such work and systems whether or not specifically mentioned in the specifications or on the drawings. All work shall be fully correlated with the work of other crafts. This section of Division 20-24 is a part of all other sections of Division 20-24.

B. Each Contractor shall study the Contract Documents included under this contract to determine exactly the extent of work provided under this contract, as well as to ascertain the difficulty to be encountered in performing the work on the drawings and outline hereinafter and in making new connections to existing utilities, installing new equipment and systems and coordinating the work with the other Trades.

C. Notwithstanding any approvals or instructions which must be obtained by the Contractor from the Architect in connection with use of premises, the responsibility for the safe working conditions at the site shall remain that of the Contractor's, and the Architect or Owner shall not be deemed to have any responsibility or liability in connection therewith.

D. The Agreement Forms, Uniform General Conditions, Supplementary Conditions, Division 00 and Division 01 of the specifications shall apply to the work specified in Division 20-24.

E. Additional Site Visit Costs: Contractor shall be charged with any cost resulting from uncompleted items that require additional site trips by the Architect/Engineer.

F. The Contractor shall obtain and pay for all permits and fees associated with his work.

G. REMODEL WORK: COORDINATE ALL CONNECTIONS OF NEW EQUIPMENT WITH EXISTING SERVICE. CONTRACTOR SHALL FURNISH AND INSTALL ALL EQUIPMENT, MATERIALS, AND INCIDENTAL ITEMS REQUIRED TO MAKE SYSTEM COMPLETE AND OPERABLE.

H. **NO TOXIC OR HAZARDOUS MATERIALS, INCLUDING BUT NOT LIMITED TO PRODUCTS OR MATERIALS CONTAINING ASBESTOS, PCB AND LEAD SHALL BE PROVIDED OR INSTALLED. ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113. ALL PAINTS MUST MEET VOC LIMIT OF GREEN SEAL ENVIRONMENTAL STANDARD GS-11. ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

I. An extra copy of all Field Reports shall be kept in a separate notebook set up in the Construction Manager's Trailer. Contractors shall use these reports to check off that each individual item noted has been completed. Each item shall be initialed and noted when completed. Use this notebook to keep record of all test and results (i.e. wastewater test, water line tests, etc.

J. **Drawings:**
Architectural Background Files – Architectural Revit Models and CAD files to be used for background files, MEP drawings are not background files. Architectural Revit Models and CAD files are used for shop drawings backgrounds. They must be obtained from the architect and cannot be given from the engineer. Reference Architect for cost of Architectural Files.

MEP Drawings – These drawings cannot be used for shop drawings, as they are diagrammatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades. If MEP floorplan files are requested they may be obtained with a signed confidentiality release form, only as outlined below. These files may be used in conjunction with this project only. There are no guarantees of compatibility or accuracy; all technical support will be billed hourly at current Engineer's Rates. Engineer does not charge for actual file, but does charge for time required to prepare the files in format as requested by the Contractor. Fees will be based on Engineer's current hourly rates. Deposit of $500 must be paid prior to beginning file preparation and balance must be paid prior to release of any files. Total fee based on actual time required by Contractor's request. See submittal and shop drawing section for additional information.

MEP CAD Files that will be released.

- If no Architectural RCP is available for light locations. Lighting Floorplans will be released.
- Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.
- Fire Alarm/Fire Sprinkler/Intercom etc… Contractors must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this portion of specifications will be cut and pasted into an email for you to read.

1.02 PRE CONSTRUCTION MEETING

A. DDC Contractor, Mechanical Contractor, Test and Balance Representative and representatives for each type of HVAC gear that requires interface beyond 'on/off' control will meet in the office of HCE prior to initial control submittal.

B. The purpose of this meeting is to introduce all representatives who will need to coordinate with each other to insure a working project.

C. Each representative is to come prepared with sequences of operation, schematics and written instructions as to which points require what type of signal for each function and how tie-ins and integrations are to occur. If pulsed signals are required to keep a device on, bring it to the attention of the team and provide specific information. Do not assume others understand the inner workings of your gear or controls. Discuss exactly what type signals are acceptable to gear and how to set it up to receive and act on that signal.

D. Newer multistage air volume split systems, RTU's, etc. have different sequences and control tie-ins than older conventional units. Exact requirements for a given type and brand of equipment must be coordinated by the equipment supplier with the Controls Contractor and with the Test and Balance Contractor.

E. Test and Balance Contractor must verify air flow and delta T's at every stage of unit capacity to insure that unit is providing the correct CFM based on the capacity stage it is on so that the unit does not end up with low stage cooling and high stage blower which will not dehumidify. Equipment supplier is to provide Test and Balance Contractor with a quick start up guide to show where and how to set up fan speed selections and outside air dampers so that only minor balancing occurs at dampers serving grilles.

1.03 SITE INSPECTION

A. Prior to bidding the Contractor shall visit and examine the site verifying all existing items and familiarize himself with existing work conditions and understand the conditions which affect performance of the work of this Division before submitting bids for this work. The submission of bids shall be deemed as evidence of such visits and examinations.

B. All bids shall take the existing conditions into consideration and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility. No subsequent allowance for time or money will be allowed for work or change related to failure to examine site conditions.

1.04 RELATED WORK SPECIFIED ELSEWHERE

A. All work covered by this section of these specifications shall be accomplished in accordance with the respective drawings, information or instructions to bidders, and general provisions of these specifications. Any supplementary conditions, special conditions, addenda, or directives which may be issued by the Owner's representative herewith or otherwise shall be complied with in every respect.

1. Electrical Specifications: Division 26-28.

2. Mechanical, Electrical, Plumbing Drawings

B. Unless otherwise indicated on the Electrical Drawings or in Mechanical Specifications, provide all mechanical equipment motors, motor starters, disconnect switches, thermal overload switches, control relays, time clocks, thermostats, motor valves, damper motors, electric switches, electric components, wiring, and any other miscellaneous Division 20-24 controls.

C. Carefully coordinate all work with the electrical work shown and specified elsewhere in these documents.

D. Motors: Furnish electric motors designed for the specific application and duty applied, and to deliver rated horsepower without exceeding temperature ratings when operated on power systems with a combined variation in voltage and frequency not more than plus or minus 10 percent of rated voltage.

E. Verify from the drawings and specifications the available electrical supply characteristics and furnish equipment that will perform satisfactorily under the conditions shown and specified.

F. Size motors for 1.15 service factor, not to exceed 40 degrees temp. Rise above ambient.

G. Provide self-resetting thermal overload switch for fractional horsepower motors.

H. Electrical Contractor to provide conduit and junction boxes for all sensors and exterior conduit for controls to mechanical equipment. Conduit for space sensor to extend from junction box to above accessible ceiling. Conduit for exterior equipment to extend from equipment through wall or roof to above an accessible ceiling. Any control wiring in exposed ceiling areas to be in conduit by Controls Contractor for protection. Controls Contractor to coordinate on all conduit requirements. Coordinate locations with Electrical Contractor.

I. Duct smoke detector in supply and return air to be provided by Fire Alarm Contractor, installed by Mechanical Contractor, tied into HVAC control circuit by Mechanical Contractor and to fire alarm panel by Fire Alarm Contractor.

J. The electrical design and electrical drawings are based on the equipment and/or electric motors of the type, size and electrical characteristics shown and specified on the mechanical drawings and any change in equipment and/or motor size or type brought on directly or indirectly by a substitution of mechanical equipment having characteristics requiring a change, shall be the responsibility of the Mechanical Contractor and the entire cost of such change, including conduit, wiring, motor starting equipment, etc., shall be paid for by the Mechanical Contractor at no additional charge, unless the substitution was initiated by the Owner. Submittals must clearly show any deviations. Mechanical Contractor is responsible for coordinating any required changes with the Electrical Contractor, prior to Electrical Contractors ordering of panels and associated equipment.

K. Mechanical contractor assumes requirements of Controls Contractor when there is no separate Controls Sub-Contractor.

1.05 WORK NOT INCLUDED

A. Certain labor, materials, or equipment may be provided under other sections of these specifications, by utility companies, or by the Owner. When such is the case, the extent, source and description of these items will be as indicated on the Drawings or described in the specifications, but the Contractor is responsible for verifying with all parties involved as to the extent of his requirements of work.

1.06 SPECIFICATION TERMINOLOGY (Definitions)

A. Streamlining: In many instances, the products, reference standards, and other itemized specifications have been listed without verbiage. In these cases, it is implied that the Contractor shall provide the products and perform in accordance with the references listed.

B. "Furnish" means to purchase and deliver material as shown and specified, including mark-ups, and cart the material to an approved location at the site or elsewhere, as noted or agreed.

C. "Provide/Install", as used in these specifications, means furnish all material, labor, sub-contracts, and appurtenances, including mark-up required for a complete, operating, finished system.

D. "Rough-in and Connect Only" means provide an appropriate system connection, such as supplies with stops, continuous wastes with traps, shut-off valves required, and all piping connections, testing, etc., for proper operation, and to install equipment furnished. Equipment furnished is received, uncrated, assembled and set in place by supporting crafts unless they make prior arrangements to hire the mechanical installer for this work.

E. "Accessible" means arranged so that an appropriately dressed maintenance man may approach the area in question with tools and products necessary for the work intended, and may then position himself to properly perform the task to be accomplished, without disassembly or damage to the surrounding installation. It shall also be no more than four feet (4') above a ceiling.

F. "Serviceable" means arranged so that the component or product in question may be properly removed, and replaced without disassembly, destruction, or damage to the surrounding installation.

G. "Product" is a generic term which includes materials, equipment, fixtures, and any physical item used on the project.

H. Wherever the term "shown on drawings" is used in the specifications, it shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.

I. "Conduit" includes, in addition to conduit, all fittings, hangers and other accessories relative to such conduit. "Piping" includes, in addition to piping, all fittings, valves, hangers and other accessories relative to such piping.

J. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction, crawl spaces, etc.

1.07 DIAGRAMMATIC DRAWINGS

A. Drawings and specifications encompass a system that will integrate with the structural, electrical, and Architectural design of the building.

1. Drawings and specifications are complementary, each to the other; what is shown on one is as binding as if called for in both.

2. Where drawing details, plans, and/or specification requirements are in conflict, and where conduit, duct and piping sizes of the same run are shown to be different between plans and specifications or details, the most stringent requirement will be included in the Contract.

Systems and equipment called for in the specification and/or shown on the drawings shall be provided under the contract of each Trade as if it were required by both the drawings and the specifications. However, prior to ordering or installation of any portion of work which appears to be in conflict, such work shall be brought to the Architect's attention for direction as to what is to be provided.

B. The drawings are partly diagrammatic in character and do not show exact locations, all offsets, or give exact elevation in piping, fittings, duct, conduits, etc. Also, the drawings do not necessarily show in minute detail all features of the installation. Contractor is to install all products coming with manufacturer's written instructions and installation details per the manufacturer's instructions, unless specifically instructed to deviate by project engineer. Contact engineer for direction if conflicts occur for direction. Contractor shall physically arrange the systems to fit in the space available and shall carefully investigate structural and finish conditions, arrange work accordingly and provide a complete and satisfactorily working installation. Provide all work shown on the drawings and specified, unless otherwise stated. No subsequent allowance will be made due to failure to coordinate work prior to installation.

C. The Architectural, Structural, Civil and Electrical plans and Specifications and other pertinent documents issued by the Architect are a part of these Specifications and the accompanying Mechanical Drawings and shall be complied and coordinated with in every respect. All drawings and specifications mentioned above shall be examined by all bidders. Failure to examine all drawings for coordination and quantities shall not relieve the Contractor of responsibility and no subsequent allowance for time or money will be allowed.

1.08 MATERIAL AND EQUIPMENT SUBMITTALS

A. Submittals: Provide submittals for all products and systems described in Division 20-24 and shown on the drawings to demonstrate compliance with the requirements of the project. Furnish equipment submittals in the manner described elsewhere in these specifications.

B. Submit to the Engineer, after the award of the contract or as dictated by project schedule, a type written list of those items of equipment and appurtenances which will be furnished. Include the name or description of the item, name of manufacturer, model or type, catalog number and manufacturer's printed information. The information submitted shall include overall dimensions, weights, voltage rating, phase, wiring diagrams, etc., and nameplate data. Assemble cut sheets into separate submittals as defined in this section or by Specification Section. Submit priority items and long lead time first. Then follow with remaining items. This will allow for faster review and response to accommodate project schedule. **Any submittal with all sections under one (1) cover will be returned and required to be broken into separate submittals.** The Engineer's check will be general and does not relieve the Contractor of final responsibility to comply with the Contract Documents in all respects.

C. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation is the sole responsibility of the Contractor. **Warranties cannot be reduced through the submittal process.**

D. Contractor shall indicate items being used on cut sheets by highlighting or arrowing to actual part number. Submittals may be returned without checking if submittals not appropriately marked.

E. **'Individual submittals' means separate submittals with <u>unique submittal numbers for each specification section</u>. Separate PDFs for each Submittal number.**

F. <u>HARDCOPY SUBMITTAL REQUIREMENT</u>: Hardcopy submittals will not be required by Engineer.

G. **PDF SUBMITTAL REQUIREMENT:**
For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each specifications section must be a separate pdf file, **one giant pdf for all sections will be rejected**.

PDF FILE: MUST BE NAMED AS FOLLOWS:
JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

EMAIL TITLE/SUBJECT: FOR SUBMITTALS MUST BE AS FOLLOWS:
JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

Failure to follow these instructions will result in the submittal never reaching the engineer and not being checked. Delays cause by not following these procedures are the sole responsibility of the contractor. Emailed submittals must come from the Architect and must not be emailed directly from the contractor. Do not Carbon Copy the Engineer on Emailed submittals.

H. **Multiple re-reviews required due to Contractor not following instructions, specifications, etc. will be billed to Contractor at Engineer's current hourly rates. This shall be paid prior to submittal approval.**

I. **SUBMITTALS WILL BE RETURNED IN ORDER OF CONSTRUCTION OF THE PROJECT, NOT NECESSARILY IN ORDER SUBMITTED**. If all sections are submitted under one binder and transmittal, each section will be returned at the appropriate time for construction phasing. Mechanical Equipment will not be reviewed until "Mechanical/Electrical Coordination Sheet" has been submitted. Mechanical Equipment, Mechanical Controls and Plumbing Fixtures may require extended review time. **IF SUBMITTALS ARE SUBMITTED EARLY RELATIVE TO CONSTRUCTION PHASING, SUBMITTALS MAY BE HELD, REVIEWED AND RETURNED AT THE APPROPRIATE TIME FOR CONSTRUCTION PHASING, NOT NECESSARILY 2 WEEKS.**

J. **DO NOT SUBMIT THE FOLLOWING SECTIONS UNLESS DEVIATING FROM THE SCHEDULES/SPECIFICATIONS. Provide directly to General Contractor/CMR for inclusion into O & M Manuals. If deviating from the specifications, submittal will be required. (Write summary sheet of deviations and highlight items that are different to allow for proper review.):**

1. 20 01 00 – Basic Materials and Methods – Only items listed
   - Valve Tag / Markers
   - Pipe Identification / Labels
   - Access Panels / Doors
   - Valves
2. 20 07 00 – Insulation – Only items listed
   - Insulation
   - Duct Tape
3. 22 11 17 – Relief Valves
4. 22 13 16 – Liquid Waste Transfer
5. 23 30 00 – Air Distribution – Only items listed
   - Isolators
   - Spin-in Fittings
   - Fire Dampers Installation Detail
   - Fire Damper
   - Flexible Connector
   - Fire Smoke Dampers / Details
   - Flexible Duct
   - Volume Damper
   - Air Extractors

K. **PDF Submittals** for the following items:
Separate PDF for each Submittal number is required.

1. 20 00 00 – General Provisions – Only items listed
   - Roof Opening Shop Drawings
   - Mechanical/Electrical Coordination Sheet
2. 20 01 00 – Basic Materials and Methods – Only items listed
   - Fire Proofing/Fire Caulk
   - Piping
3. 20 07 00 – Insulation – Only items listed
   - Metal Jacket & Fittings
   - Internal Lining
4. 21 00 00 – Fire Sprinkler Product Data
5. 22 11 16 – Water Distribution Systems – Only items listed
   - Water Hammer Arrestors
   - Piping
6. 22 11 17 – Water Heaters
7. 22 13 16 – Liquid Waste Transfer – Only items listed
   - Cleanouts
   - Piping
8. 22 13 17 – Acid Waste Piping – Only items listed
   - Acid Dilution Basin
9. 22 30 00 - Plumbing Fixtures and Trim – Only items listed
   - Plumbing Fixtures and Trim
   - Floor Drains
10. 23 09 XX – Controls
11. 23 30 00 – Air Distribution – Only items listed
    - Louvers/Hoods
    - Grilles/Registers/Diffusers
    - Exhaust Fans
    - Supply Fans
    - Unit Heaters
12. 23 63 01 – Chilled and Hot Water Systems – Only items listed
    - Pumps
    - Chillers
    - Boilers
13. 23 70 XX – Mechanical HVAC Equipment - Only items listed
    - Condensers
    - Condensing Units/Heat Pumps
    - Air Handlers
    - Rooftop HVAC Units
    - Makeup Air Units

L. Data Required for Review: Mark submittal literature and shop drawings clearly by individual sections, and include all equipment and material shown on drawings and specified. ANY DATA NOT CLEARLY MARKED OR NOT APPROPRIATELY SUBMITTED WILL BE RETURNED WITHOUT CHECKING. Indicate the following:

1. Specification reference and/or drawing reference for which literature is submitted for review with an index, following specification format, and item by item identification.

2. Manufacturer's name and address, and supplier's name, address, and phone number.

3. Catalog designation or model number.

4. Rough-in data and dimensions.

5. Performance curves and rated capacities with performance data marked.

6. Motor characteristics and wiring diagrams.

7. Operation characteristics.

8. Complete customized listing of equipment, characteristics, accessories, etc., specified. Indicate whether item is "As specified." Mark out all non-applicable items. The terminology "As specified" used without this customized listing is not acceptable.

9. Wiring diagrams for the specific system operation. Complete wiring with diagrams showing all connections to each type of actual equipment being installed on project, complete with part numbers of controls for each type of equipment.

10. **Submit written sequence of operation for all modes of operation for each piece of mechanical equipment. Give narrative explaining exactly what control signals are required to activate <u>each</u> mode of a particular unit's operation. Include information about which signals override others internally (when applicable). Submit this information with equipment submittal and provide a copy to the Controls Contractor so it can be integrated into the control scheme and control submittals. Indicate whether 24 VAC, 4-20 MA, 0-10VDC or line voltage is required for controls.**

11. **Provide HVAC equipment with a controls interface that is suitable for connection to a standard conventional thermostat and/or non-proprietary DDC control systems.**

12. **Ductwork Shop Drawings: Engineer requires 1 (one) HARDCOPY, full-size at 1/8" scale, sheets size to match project for engineer review and engineer records. Additional copies per Architect and Owner requirements. PDF's will be required for owner and architect records.**

13. **<u>BREAKOUT SUBMITTALS INTO PRIORITY ITEMS.</u>**

M. **Contractor to submit "Mechanical/Electrical Equipment Coordination Sheet" with equipment submittal for all HETD's, RTU's, GU's, AHU's, CU's, HP's and MAU's. Reference chart at end of section.**

N. When requested, present samples of all materials proposed for use to the Engineer for his approval.

O. Certify Shop Drawings have been checked for compliance with Contract Documents. Certify that the materials submitted can be delivered and installed according to the construction schedule.

P. Select all other materials, not specifically described on the Drawings or in these specifications but required for a complete and operable facility, and submit to the Engineer for approval.

Q. **Substitutions:** ("Substitution Request" form must be submitted)

1. Equipment listed as equal is indicated to be equal in quality to equipment designed around. It does not mean equal in dimension or fit. It is the Contractor's responsibility to confirm dimensional differences and space requirements.

2. Request for proposed substitution of materials, methods, or processes shall be made to the Architect and if found acceptable, will be confirmed by an addendum to the Construction Documents. Where proposed substitutions are not incorporated into the Construction

Documents by addendum **PRIOR** to time of the General Contract bid opening, all bids shall be held to have been made on the basis of the materials, methods and processes required by the Construction Documents.

3. Equal Materials: It is not the intent of the Specifications to limit materials to the product of any particular manufacturer. Where definite materials, equipment and/or fixtures have been specified by name, manufacturer or catalog number, it has been done so as to set a definite standard and a reference for comparison as to quality, application, physical conformity, and other characteristics.

4. Acceptance of substitution by the Engineer does not relieve the Contractor of responsibility for proper operation of the systems, compliance with specifications, necessary changes due to dimensional differences or space requirements, and of work on schedule.

5. Where equipment of the acceptable manufacturers requires different arrangement or connections from those shown, it shall be the responsibility of the Contractor to install the equipment to operate properly and in harmony with the original intent of the drawings and specifications. When directed by the Architect, the Contractor proposing substitutions shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all necessary changes in all affected related work provided under other Sections, including location of rough-in connections by other Trades, conduit supports, insulation, etc. All changes shall be made at no increase in the Contract amount or additional cost to the other Trades and/or Owner.

6. **Submit fully completed "Substitution Request" form located at end of this section. If this form is not submitted, all substitution request will be automatically rejected.**

7. For substitutions that require substantial review by engineer to ensure equality, the contractor requesting substitutions shall reimburse the engineer at current hourly rates for all review time. This shall be paid prior to submittal approval. This applies to all equipment not previously approved on construction documents.

a. Mechanical Equipment

b. Contractor Cost Savings Packages Requiring Substantial Review Time

1.09 SHOP DRAWINGS REQUIRED

A. Prepare and submit working construction drawings as requested, specified, and otherwise necessary to demonstrate proper planning for installation and arrangement of all work. Layout drawings to scale and show dimensions where accuracy of location is necessary for coordination or communication purposes. Show work of all trades, including Architectural, Structural, Mechanical, and Electrical items which may be pertinent to proper and accurate coordination. Provide shop drawings for all products, ductwork, systems, system components and special supports which are not standard catalog products and which may be fabricated for the Contractor or by the Contractor. Show top and bottom elevation of ductwork and equipment as it will be installed. Show offsets required to miss structural and other items of interference. Identify all shop drawings as to which section and paragraph of the specifications and/or drawing number the item is covered under. Ductwork layout/shop drawings to be done at a minimum 1/8" = 1'-0" scale. AHU's, CU's, HP's, RTU's, etc. are to be shown actual scaled size and configuration of the actual equipment being used.

B. Architectural Revit Models and CAD files to be used for backgrounds in preparation of ductwork and sprinkler shop drawings and shall be obtained from the Architect. Confirm requirements and stipulations for obtaining floor plan backgrounds with Architect and with other sections of specification. Engineer's drawings and CAD files **may not** be used for Shop Drawings. Reference 1.01,J.

C. ALL SHOP DRAWINGS OF MECHANICAL ROOMS/MEZZANINES SHALL SHOW ALL FLOOR DRAINS, HVAC, PLUMBING, AND ELECTRICAL EQUIPMENT, INCLUDING ELECTRIC PANELS, TRANSFORMERS AND DISCONNECT SWITCH LOCATIONS. COORDINATE WITH ELECTRICAL AND PLUMBING CONTRACTOR.

D. Provide roof shop drawing indicating dimensioned locations and sizes for all roof mounted equipment, supports, openings and plumbing vents in ample time for proper coordination of all trades.

E. Submission of copies of the Engineer's drawings does not constitute shop drawings and is not acceptable.

F. Submittal of complete engineering submittal data for products and equipment shall be made in sufficient copies to provide one (1) hardcopy of all data to be retained by the Engineer, additional copies as required by the Contractor, Architect and Owner. Provide an electronic copy in PDF format and CAD if available for record keeping purposes for Engineer, Architect, and Owner with close out documents described elsewhere in specifications.

G. General Contractor shall transmit a CAD copy of ductwork shop drawings to sprinkler contractor prior to submission of sprinkler shop drawings.

H. Ductwork shop drawings shall be submitted and reviewed prior to any ductwork being installed.

I. MECHANICAL CONTRACTOR MUST SUBMIT "MECHANICAL/ELECTRICAL COORDINATION SHEET" WITH MECHANICAL EQUIPMENT SUBMITTAL FOR PROPER COORDINATION PURPOSES WITH ELECTRICAL CONTRACTOR FOR ACTUAL EQUIPMENT BEING INSTALLED OR SUBMITTAL WILL BE REJECTED.

1.10 RECORD DRAWINGS

A. Reference requirements stated elsewhere in the Specifications.

B. THE CONTRACTOR SHALL TAPE ALL ADDENDA'S ISSUED DURING BIDDING TO HIS CONSTRUCTION AND RECORD DRAWING SET PRIOR TO COMMENCING CONSTRUCTION. PAY REQUESTS WILL NOT BE PROCESSED UNTIL THE CONTRACTOR HAS COMPLIED WITH THIS REQUIREMENT.

C. In addition to other requirements, a master Record Drawing print set (separate from field sets) shall be kept in the General's site trailer and marked up weekly as the work progresses, to show exact dimensioned location and routing of all mechanical work which will be permanently concealed. Show routing and location of items cast in concrete or buried underground. Work located in spaces with access, or above suspended ceilings, is not considered permanently concealed. Show complete routing and sizing of any significant revisions to the systems shown. Show the location of all valves and their appropriate tag identification. Indicate locations of all existing active and inactive piping uncovered during construction. **Keep marked up set at site for review at site meetings.**

D. The marked-up and colored-up prints will be used as a guide for determining the progress of the work installed for draw requests. They shall be inspected periodically by the Architect and Owner's Representatives, and they shall be corrected immediately if found either inaccurate or incomplete. **This procedure is mandatory.**

E. The Contractor shall be responsible for updating and/or marking all items, including but not limited to floor plan changes, system changes, addendums, change orders, etc. on the prints to "As-Built" conditions. At the completion of the job, marked up As-Built Drawings shall be submitted to the Architect for final review and comment. These corrected prints together with corrected prints indicating all the revisions, additions and deletions of work, shall form the basis for preparing a set of record drawings.

F. Using the "Record Drawing Set", the Contractor shall print two (2) complete sets of prints one for

submission to the Owner and one rolled in a 4" PVC pipe in main electric room mounted to wall and labeled. Tape all edges. The contactor shall provide pdf copies/scans for owner record purposes.

G. The Contractor shall bear all the costs of producing the "Record Drawing Set".

H. All equipments **model and serial numbers** must be included on start up forms turned in to the owner. For split systems, this includes all model and serial numbers for all indoor sections or components as well as outdoor units. These are required for owner inventory and for processing of any utility rebate forms. Utility rebates require the model and serial numbers associated with a given unit number to match, in case the job is spot checked prior to issuing a rebate.

1.11 CODES, REGULATIONS AND ORDINANCES

A. All work shall comply with the current applicable local, state and federal codes and ordinances. Follow recommended practices as set down by ASME, SMACNA, ASHRAE, NFPA, applicable Building Code, applicable Mechanical Code, applicable Plumbing Code, National Electrical Code (NEC), AGA, ADA AND OSHA, as they apply to this project, except in cases where local statutes govern. The contractor shall verify with the latest adopted local codes, ordinances and amendments that apply to this project with the authority having jurisdiction. **PROVIDE LOCKING REFRIGERATION ACCESS PORT CAPS FOR ALL EQUIPMENT WITH REFRIGERANT LOCATED OUTDOORS ON GROUND OR ON ROOF.**

B. In cases of difference between Building Codes, State Laws, Local Ordinances and Industry Standards and the Contract Documents, each Subcontractor shall promptly notify the Architect in writing of any such difference, as applicable to his work.

C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities having jurisdiction, the most stringent requirements of the aforementioned shall govern.

D. Should the Contractor perform any work that does not comply with the requirements of the applicable Building codes, State laws, Local Ordinances and Industry Standards, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect.

1.12 DELIVERY AND STORAGE OF EQUIPMENT AND MATERIAL

A. All equipment and materials shall be protected from physical, moisture absorption, metallic corrosion and weather damage from the time of delivery until completion of the project. This includes erection of temporary shelters and covering items in the building with protective covering. Store items subject to moisture damage such as controls in dry, heated space. Failure to comply with the above to the satisfaction of the Owner/Architect will be sufficient cause for the rejection of the equipment or material in question. Upon such rejection, the damaged equipment or material will be completely replaced with new by the Contractor at no charge to the Owner.

B. Provide covers on all ends and openings of pipes, conduits, ducts, etc. to keep out insects, dirt, dust and debris during entire construction process. This includes properly covering unassembled ductwork, etc. stored on jobsite prior to installation.

C. The Manufacturer's directions are to be followed from delivery, storage, protection and installation of equipment and materials. Notify the Architect in writing of conflicts between requirements of Contract Documents and manufacturer's direction.

D. Large pieces of equipment which are too large to permit access through doors, stairways or access opening shall be placed in the space before enclosing the structure. After equipment is placed, it shall be thoroughly protected from damage.

1.13 CLEAN-UP

A. Remove debris and waste materials from within the construction areas and transport off-site, daily.

B. Keep the construction area clean, free from hazard, and orderly arranged.

C. Pay all costs of waste removal and disposal. Reference General Conditions for further information.

D. Dispose of waste materials in accordance with all regulations which govern.

E. Take all precautions to protect persons who enter the construction area from hazardous conditions, hazardous waste, toxic waste, or other unsafe conditions.

F. Upon completion of construction, remove all debris, waste materials, unused materials, temporary constructions, vehicles, tools, fencing, etc. to Owner's satisfaction.

G. All equipment and materials shall be protected from physical moisture absorption, metallic corrosion and weather damage from time of delivery to completion of project. Replace any damaged materials.

PART 2 – PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Unless otherwise indicated, provide only new equipment and materials.

B. On all major equipment components, provide manufacturer's name, address, model number, and serial number permanently attached in a conspicuous location.

C. All materials furnished under these specifications shall be the standard product of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest approved standard design.

D. GUARANTEE

1. The Contractor and Manufacturers shall provide a ONE (1) YEAR guarantee for all work under the Electrical, HVAC, Plumbing and Fire Protection Trade. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacturer and Contractor may have by law or by other provisions of the Contract Documents. **In any case, such guarantees and warranties shall commence when the Owner accepts the mechanical/electrical system, as determined by the Architect.**

2. All materials, items of equipment and workmanship furnished under each Section shall carry a ONE (1) YEAR warranty against all defects in material and workmanship. Any fault under any Contract, due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Contractor for the work under his Contract, including all other damage done to areas, materials and other system resulting from this failure.

3. The Contractor shall guarantee that all elements of the system, which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

4. Upon receipt of notice from the Owner of failure of any part of any systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Contractor for his respective work, as applicable.

5. Additional extended guarantees required for work on this project. The additions and/or extensions to the standard one year guarantee previously described are to be provided in writing, by the manufacturer or an approved insurance underwriter. The guarantee is to cover all parts and/or labor as specified below.

Master Extended Guarantee List:

a. Gas heat exchangers in all furnaces, make-up air heaters, “neutral air” make-up air units, high efficiency triple deck (HETD) units, unit heaters and packaged rooftop units to have an additional nine (9) year parts only guarantee. (Non-prorated)

b. All comfort air conditioning and heat pump compressors are to have an additional four (4) year parts only guarantee. (Non-prorated)

c. All computer grade HVAC equipment compressors are to have an additional one (1) year parts only guarantee. (Non-prorated)

d. All “neutral air” make-up air units and high efficiency triple deck (HETD) units are to have the following additional guarantees (Non-prorated):

1) Two (2) year total unit performance.

2) Additional four (4) year parts on compressors.

3) Additional four (4) year parts and performance on total enthalpy and sensible recovery wheels, heat pipes, plate and frame exchangers and run around loops.

4) Provide unit with one (1) spare belt for each fan and wheel to be used at Owner’s discretion after the guarantee period expires.

5) Additional one (1) year parts and labor on entire make-up air unit package against water leaking into the unit and/or into the building through any roof curb mounted unit. Manufacturer’s representative is to certify proper installation on each unit in writing.

e. All chillers to have additional (4) four year manufacturer’s parts and labor, bumper to bumper guarantee (Non-prorated), including refrigerant.

f. Gas radiant heaters to have additional 1 year parts warranty on controls and additional 14 year parts warranty on the “effect” tile stainless steel burners.

6. Furnish, before the final payment is made, a written guarantee covering the above requirements.

7. Additional/extended guarantees listed above are Non-negotiable, and can’t be amended through the submittal process.

PART 3 - EXECUTION

3.01 CUTTING AND PATCHING

A. The Contractor shall notify the General Contractor and other Subcontractors in ample time of the location of all chases, sleeves and openings required in the construction for the proper installation of his work. The Contractor shall do all core drilling of individual holes and all cutting for his work, except square or rectangular openings in the structural slabs, which shall be cut by the Contractor at locations shown on the drawings. In no case, however, shall a beam or column be cut without the approval of the Project Structural Engineer.

B. On completion of this work or as work progresses, the Contractor shall make all repairs and do all patching required as a result of the work under this contract. All patching shall be performed in a manner that will restore the surrounding work to its original conditions and to the satisfaction of the Owner.

C. Any cutting and patching necessary as a result of the Contractor's failure to notify the General Contractor of all the required openings, shall be at the expense of the Contractor.

3.02 OBLIGATIONS/RESPONSIBILITIES

A. The Contractor binds himself, his partners, successors, assigns and legal representatives to the Owner in respect to all covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract, or sublet it as a whole without the written consent of the Architect/Owner, nor shall the Contractor assign any monies due or to become due to him hereunder, without the previous written consent of the Owner/Architect.

B. The Contractor shall supervise and direct the Work using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, safety, sequences and procedures, and for coordinating all portions of the work under his Contract.

C. The Contractor shall provide, without extra charge, all incidental items required as a part of the work, even though not particularly specified or indicated, and if he has good reason for objecting to the use of a material, appliance, or type of construction shown or specified, he shall register his objections with the Architect/Engineer, in writing; otherwise, he shall proceed with the work under the stipulation that a satisfactory job is required.

3.03 TESTS AND INSPECTIONS

A. Schedule, obtain, and pay for all fees and/or services required by local authorities and by these specifications, to test the mechanical systems as specified in these specifications.

B. Request for Tests: Notify the Architect a minimum of 24 hours in advance of tests. In the event the Architect does not witness the test, certify in writing that all specified tests have been made in accordance with the specifications.

C. Deficiencies: Immediately correct all deficiencies which are evidenced during the test and repeat test until system is approved. Do not cover or conceal piping, equipment or other portions of the mechanical installations until satisfactory tests are made and approved.

D. Operating Tests: Upon request from the Architect, place the entire mechanical installation and/or any portion thereof, in operation to demonstrate satisfactory operation.

E. Log of Tests: The Contractor shall set up a testing log form to be kept at the job site with the record drawings. All tests shall have pertinent data logged at the time of testing. Pertinent data is to include: date, time, description, personnel, system tested (and extent), test conditions, test results, etc.

F. Completion: Upon completion of the mechanical installation, demonstrate to the Architect's satisfaction that the systems have been installed in a satisfactory manner in accordance with the plans, specifications, and applicable codes. Demonstrate dynamic operation of all systems. Show that all controls are operable and are properly adjusted in accordance with the requirements of the final systems balance, that all systems are properly balanced, that all equipment operates properly, that filters and strainers are clean, and that all components of all systems are installed and adjusted for proper operation.

1. Prior to final inspection, all work under this Division to be completed, insure all equipment is operational and final testing and balance reports have been submitted and approved.

3.04 OPERATING INSTRUCTIONS

A. Prior to final acceptance, instruct an authorized representative of the Owner on the proper operation and maintenance of all mechanical systems, equipment, and controls under this contract. Make available a qualified technician for each component of the installation for this instruction. Give these operation instructions after the operation and maintenance manuals have been furnished to the Owner. Submit written certification, signed by the Contractor, and an authorized representative of the Owner, that this has been completed.

3.05 COORDINATION OF WORK

A. Each Contractor shall compare his Drawings and Specifications with those of other Trades and report any discrepancies between them to the Architect, and obtain from the Architect written instructions to make the necessary changes in any of the affected work. All work shall be installed in cooperation with other Trades installing interrelated work. Before installation, all trades shall make proper provisions to avoid interferences in a manner approved by the Architect.

B. Each Contractor shall coordinate the location of his systems so that all outside air intakes are located in such a way as to prevent cross-contamination from plumbing vents, flue pipes, exhaust fans, etc. Such a distance shall be not less than 10 feet.

C. Locations of conduit, ducts, piping, sprinkler heads and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Exact routing and location of system shall be determined prior to fabrication or installation. Coordinate routing of major electrical conduits with Electrical Contractor prior to fabrication of ductwork and piping.

D. Offsets and changes of direction in all conduit, ducts and piping systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings.

E. Where discrepancies in scope of work as to what Trade provides items, such as starters, disconnects, flow switches and the like exist, such conflicts shall be reported to the Architect prior to signing of the Contract. If such action is not taken, the various Trades shall furnish such items as part of their work for complete and operable systems and equipment, as determined by the Architect.

F. The HVAC, Plumbing and Fire Protection Subcontractors shall verify with Electrical Subcontractor the available electrical characteristics for all motors and equipment before ordering and submitting of respective gear. Verify actual connection points prior to installation and roughing-in. Mechanical and Electrical Contractor are responsible for coordination of electrical requirements and final fuse sizes of all A/C equipment. When Mechanical Contractor substitutes equipment that requires additions or upgrades to electrical system, he shall bear all costs arising from such substitutions. Reference "Mechanical/Electrical Coordination Sheet" in specifications.

G. The Contractors are to avoid routing conduit through fire rated assemblies where practical. Each trade is responsible for proper coordination of required sleeves or block-outs with rated assembly installers. Each trade is responsible for providing sleeves, as required, for his work. Each trade shall verify acceptable tolerances around penetrating item in fire assembly before beginning fire sealing.

H. Mechanical Contractor and Controls Contractor shall coordinate all requirements of equipment and controls to insure a fully operational system.

I. Coordinate all plumbing rough-in through floor(s) with structural concrete TEE's/structural steel. Do not pass through stem of TEE's.

3.06 OPERATION AND MAINTENANCE MANUALS

A. Provide one (1) Operation and Maintenance manual for training of Owner's personnel in operation and maintenance of systems and related equipment in the manner described elsewhere in these specifications. In addition, organize manuals and include data and narrative as noted below (bind each manual in a hard-backed loose-leaf binder. Use 8-1/2" x 11" white paper). Provide PDF copy of O&M for owner records

B. Operating Sequence and Procedures:

1. Contents: In each chapter, describe the procedures necessary for personnel to operate the system and equipment covered in that chapter. Also, include a copy of System Balancing Report.

2. Typewritten Operating procedures: Write procedures for start-up, operation, and shutdown.

a. Start-up: Give complete step-by-step instructions for energizing equipment, making initial setting and adjustments whenever applicable.

b. Shutdown Procedure: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instruction in that order.

C. Maintenance Instructions:

1. Provide a schedule of preventive maintenance for each product. Recommend frequency of performance for each preventive maintenance task: i.e., cleaning, inspection, etc.

D. Manufacturer's Brochures: Include manufacturers' descriptive literature covering all appurtenances used in each system, together with illustrations, exploded views and renewal parts lists. Provide nearest manufacturers' representatives name, address and phone number.

E. Shop Drawings: Provide a copy of all corrected, approved submittals and shop drawings covering equipment for the project either with the manufacturers' brochures or properly identified in a separate subsection.

F. Spare Parts Lists: Include a list of all equipment furnished for project, with a tabulation of descriptive data of all the spare parts proposed for each type of equipment or system. Properly identify each part by part number and manufacturer.

G. All major Owner training sessions to be videotaped in non-pixelated video in Windows file format,

3.07 OPERATION PRIOR TO COMPLETION

A. When any piece of mechanical or electrical equipment is operable and it is the advantage of the Contractor to operate the equipment, he may do so providing that he properly supervises the operation. **All HVAC equipment shall be shut down when painting, sanding and similar construction operations detrimental to the equipment are being done.** The warranty period shall, however, not commence until such time as the equipment is operated solely for the benefit of the Owner at his request or as listed in 'C'. Contractor shall clean any ductwork and equipment that is dirty due to equipment operation or improper protection.

B. Any units that are operated during construction shall have filter media (Fiberbond Dual-Ply DustLok Media) placed over the exterior of return air grilles. Media shall be changed as frequently as required to keep ductwork clean.

C. Regardless of whether or not the equipment has been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust the equipment and complete all punch list items before final acceptance by the Owner. The day following final acceptance by the Owner will be the start date of the warranty period.

3.08 RECORD FOR OWNER

A. Each Contractor shall accumulate and bind in an "Operating and Maintenance" manual the following data to be presented to the Owner at the completion of the Project.

1. All warranties and guarantees and manufacturer's instruction on equipment and material covered by the contract.

2. Approved equipment brochures, wiring diagrams and control diagrams.

3. Copies of approved shop diagrams.

4. Operating instructions for heating and cooling and other mechanical systems. Operating instructions shall also include recommended maintenance and seasonal changeover procedures.

5. Repair parts lists of all major items and equipment including name, address and telephone number of local supplier or agent.

6. Valve tag charts and diagrams herein before specified.

7. HVAC balance and test results.

8. HVAC equipment start-up forms that include model and serial numbers of each piece of mechanical equipment installed, by unit mark number. For split units provide this information for all components.

9. "As-Built" Drawings as specified under "Construction Drawings" (these are not to be bound in the O&M Manual).

B. Provide reduced set of record drawing (11 x 17) indicating location and mark number of all mechanical equipment.

3.09 SITE OBSERVATION

A. Periodically, the Engineer will visit the site and review the construction progress. Field Reports will be issued noting any discrepancies or items that do not meet the intent of the contract documents found during said site visit. The contractor must answer each item listed on each field report, item by item.

B. It shall be the duty of the Contractor to personally make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the Owner, Architect or Engineer to make final acceptance of the work. Subsequent trips required because of Contractor's failure to do so, will be made at Contractor's expense.

C. The final acceptance of the work will be made jointly by the Architect and the Owner.

3.10 MECHANICAL/ELECTRICAL

A. **<u>THIS IS TO BE DONE PRIOR TO SUBMITTING HVAC EQUIPMENT.</u> Contractor to submit Mechanical/Electrical equipment coordination sheet with equipment submittal for actual equipment (HETD's, RTU's, AHU's, CU's, HP's, HRU's, Airhawks, AFU's, MAU's, etc) being installed. Reference chart at end of section. This is for Contractor coordination purposes.**

MEP/ENERGY CONSULTANTS

HCE HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

115 East Main Street Round Rock, Texas 78664

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PRE-CONSTRUCTION INSTRUCTION SHEET

Submittal/RFI Requirements

A. 'Individual submittals' means separate submittals with unique submittal numbers. One single giant PDF will be rejected.

B. 2 Submittal CATEGORIES (Reference Specifications)

a. Not required unless deviating from specification

b. PDF allowed.

PDF SUBMITTAL/RFI FILE TITLE REQUIREMENT:
For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each pdf submittal must be a separate pdf file.

PDF FILE: MUST BE NAMED AS FOLLOWS:
JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION
JOB NAME – RFI No. XX – RFI DESCRIPTION

Example: Texas ISD ES No. 2 – Submittal 8 – Plumbing Fixtures
Example: Texas ISD ES No. 2 – RFI 3 – Library Light Fixture Mounting Height

EMAIL TITLE/SUBJECT REQUIREMENTS:
Emails without Job Name and proper format will not get through email security and will be auto-deleted and not checked.

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION
JOB NAME – RFI No. XX – RFI DESCRIPTION

C. If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.

D. Time Critical Submittal Coordination Items

Mechanical to provide to General Contractor for Structural Roof Coordination

a. Mechanical to provide roof opening shop drawing as early as possible for structural coordination. Per specifications.

Mechanical to provide to General and Electrical Contractors for Gear Coordination

b. Mechanical to complete "MECHANICAL/ELECTRICAL COORDINATION SHEET" prior to electrical gear submittals for coordination with electrical contractor. Per specifications.

E. Do not submit non pre-approved substitutions during submittal time. These submittals will be automatically REJECTED. Substitution Pre-approval was at bid time.

F. Review time for multiple resubmittals of non-approved equipment will result in Contractor being billed for review time that is not part of Engineer's Scope. Engineer will bill Contractor at Engineer's Current hourly rates.

G. Email of all Submittals/RFI's must go directly to Architect. Do not Copy Engineer.

H. Engineer is not the Contractors plan reference resource. Do not submit an RFI until drawings and specifications have been reviewed first. If the answer is clearly on the drawings the response will be "The answer is clearly on the drawings, Engineer is not the Contractors plan reference resource."

I. Call before submitting a written RFI.

J. All formal Job emails must come from Architect.

K. Do not email send recurring jobsite meeting requests to Engineer. Engineer does not attend all weekly meetings. Architect will coordinate when Engineer is to be required at job site for specific meetings.

Shop Drawings and Cad Files

A. Contractor Shop Drawings must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this will be cut and paste into an email for you to read. Engineer cannot send architectural backgrounds.

B. If no Architectural RCP is available for light locations. Lighting Floorplans will be released.

C. Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.

D. Fire Alarm, Sprinkler, Intercom etc. all to use Architectural Backgrounds, must be obtained from Architect.

E. Schedule and Details sheets will not be released.

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SUBSTITUTION REQUEST

FROM: _____ DATE: _____

PROJECT: _____

RE: _____

The following has been submitted for consideration on the aforementioned project:

Specification Title, Section, Page and Article/Paragraph:

Drawings and Details Affected:

Proposed Substitution/Description:

Installer's Name:

Manufacturer's name:

☐ Point by Point Comparative Data attached - REQUIRED BY A/E (_____# of pages including cover)

Why is Substitution Being Submitted?

☐Pre-Bid Substitution (Prior Appoval): Include detailed analysis comparing proposed substitution against specified product, including redlined Specifications showing differences or deviations.

☐Specified product is not available. Explain in detail as attachment.

☐Cost Savings to Owner. Indicate comparative cost analysis as attachment.

☐Other. Explain.

Effects of Proposed Substitution?

(Attach complete explanations and technical data, including laboratory test, if applicable.) Include complete information changes to Drawings and/ or Specification that proposed substitution would require for its proper installation. Fill in blanks below:

A. Does substitution affect dimensions shown on drawings? ☐No ☐Yes

B. Will undersigned pay for changes to building design, including engineering and detailing costs caused by requested substitution? ☐No ☐Yes

C. What affect does substitution have on other trades?

_____

D. Differences between proposed substitution and specified item?

_____

E. Indicate how proposed substitution meets LEED requirements. (if applicable)

F. Manufacturer's guarantees of proposed and specified items are:
☐Same ☐Different (explain on attachment)

The Contractor and Subcontractor certifies:
- Proposed substitution has been fully investigated and determined to be equal or superior in all respectes to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Similar maintenance service and source of replacement parts, as applicable is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted By: (name, address, telephone and contact person of manufacturer and installer of proposed substitution)

_____

_____

_____

_____

_____

For A/E Use: SR# _____

☐Accepted ☐Accepted as Noted

☐Not Accepted ☐Received Too Late

☐Incomplete Information

☐No Substitutions Accepted

Reviewed by/date: _____

Comments: _____

Subcontractor's signature and date: _____

Contractor's signature and date: _____

COPY TO:

☐FILE ☐OWNER ☐CONTRACTOR

☐ENGINEER ☐_____

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MECH / ELEC EQUIPMENT COORDINATION SHEET

(THIS IS REQUIRED – NOT OPTIONAL)

MARK #	UNIT TYPE	MANUFACTURER'S RECOMMENDED MOCP	VOLTAGE	PHASE	MARK #	UNIT TYPE	MANUFACTURER'S RECOMMENDED MOCP	VOLTAGE	PHASE

END OF SECTION

SECTION 20 01 00 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes specific requirements, products, and methods of execution which are typical throughout the mechanical work of this project. Additional requirements for the specific systems will be found in the sections specifying those systems, and supersede these requirements.

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 JOB CONDITIONS

A. Obtain approval from Architect prior to cutting any structural elements or furring members.

B. Structural Interferences: Should structural members prevent the installation of piping, ducting or equipment, notify the Architect before proceeding.

C. Consider minor changes in position of equipment, piping, or ducting, as part of the contract at no additional cost to the Owner.

D. Coordinate with Structural and Architectural work to determine acceptable locations for sleeves and supports which are required but may not be specifically shown on the plans. SCHEDULE INSTALLATION OF SLEEVES AND SPECIAL SUPPORTS IN MANNER TIMELY TO THE WORK OF OTHER CRAFT. Anticipate minor offsets necessary for proper coordination with other work, and reroute systems appropriately.

E. It is the Contractor's responsibility to properly use all information found on the Architectural, Structural, Civil and Electrical Drawings where such drawings affect his work.

1.03 DIMENSION AND FIT

A. Cut materials accurately from measurements taken on the JOB SITE.

B. Do not spring or bend pipe to fit conditions or make up joints.

1.04 INTERFERENCES

A. Interferences between piping and other trades shall be handled by giving precedence to pipe lines requiring grade for proper operation. Where space requirements conflict, the following order of precedence shall generally be observed.

1. Building Lines

2. Structural Members

3. Soil and Drain Piping

4. Vent Piping

5. Refrigerant Piping

6. Supply, Return, O/A Ductwork

7. Exhaust Ductwork

8. Chilled and Hot Water Piping

9. Domestic Hot and Cold Water Piping

10. Natural Gas Piping

11. Electrical Conduit

12. Fire Protection Piping

1.05 SERVICEABILITY OF PRODUCTS

A. Furnish all products to provide the proper orientation of serviceable components to access space provided.

B. Coordinate installation of piping, ductwork, equipment, coils, system components, and other products to allow proper service of all items requiring periodic maintenance or replacement.

C. **Replace or relocate all products incorrectly ordered or installed to provide proper serviceability.**

1.06 ACCESSIBILITY OF PRODUCTS

A. Arrange all work to provide permanent, convenient, and safe access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available. Advise Architect, in a timely manner, of areas where proper access cannot be maintained. Furnish layout drawings to verify this claim, if requested.

B. Provide access doors in ceilings, walls, floors, etc., for access to traps, valves, dampers, automatic devices, and all serviceable or operable equipment in concealed spaces. Location of panels shall be submitted for approval in sufficient time to be installed in the normal course of work.

1.07 ROUTING

A. Route all pipelines and ductwork parallel with building lines, and as high as possible, except where under ground or shown otherwise on the plan.

B. Route piping and ducts to clear all doors, windows and other openings, and to avoid all other pipes and ducts, light fixtures, and similar products.

C. Conceal all pipes and ducts where routed through finished areas, unless authorized by Architect or otherwise indicated on plans.

PART 2 - PRODUCTS

2.01 MATERIAL PRODUCTS

A. Provide all products new, unused, and undamaged, of standard manufacture, and of latest design and best quality. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113. ALL PAINTS MUST MEET VOC LIMIT OF GREEN SEAL ENVIRONMENTAL STANDARD GS-11. ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

B. When a manufacturer's name appears in these specifications or schedule, it is not to be construed that the manufacturer's material does not have to meet the full requirements of the specifications or that his standard catalogue item will be acceptable.

C. All equipment installed on this project shall have local representation, local factory authorized service and local stock of repair parts.

D. All materials exposed within a plenum shall be noncombustible or shall have a flame spread index of not more than 25, and a smoke developed index of not more than 50, when tested in accordance with ASTM E 84.

2.02 Where more than one type of material (i.e., cast iron or PVC) is specified, the Contractor may choose one type; however, he must state which type of material he proposes to use in his submittal. ONLY ONE TYPE OF MATERIAL MAY BE USED IN A SPECIFIC PIPING SYSTEM, UNLESS SPECIFICALLY NOTED OTHERWISE. (I.E. WHEN DIFFERENT SIZES OF THE SAME TYPE SYSTEM REQUIRE DIFFERENT MATERIALS PER SPECIFICATIONS.)

2.03 PIPE AND FITTINGS

A. Steel Pipe: **All steel piping and fittings are to be domestically manufactured (USA).**

1. PROVIDE DOCUMENTATION IN SUBMITTAL STATING LOCATION OF MANUFACTURING.

2. Threaded: Schedule 40, ASTM A53 grade B or ASTM A120, American Standard pipe thread. Pipe 2" and under to be made up with threaded fittings.

3. Welded: Schedule 40 black, ASTM A53 grade B or ASTM A120, ANSI B16 butt weld fittings of type and wall thickness to suit pipe. Weld-O-Lets and Thread-O-Lets may be used on pipe 2-1/2" and larger where branch is a minimum of two pipe sizes smaller than main. Pipe 2-1/2" and over to be made up with welded fittings. Pipe 2” and under to be made up with threaded fittings.

4. Grooved Pipe: Schedule 40 ASTM A120 or ASTM A53 grade. Standard cut or rolled groove to coupling manufacturer's specifications. Do not use in systems exceeding 200^{O} F. operating temperature.

a. Couplings: Standard weight with gasket selected by manufacturer for service intended.

b. Fittings: Full flow malleable iron, ductile iron or steel.

c. Submit calculations of expansion allowance of joints and obtain approval prior to eliminating any special expansion compensators, swing joints, flexible connections, or vibration isolators.

d. Manufacturers: Victaulic, Gruvlok or Apollo.

5. Press fit: Use Viega Mega Press or equal by Apollo.

B. Copper pipe:

1. Type "K" or "L" hard drawn copper with wrought copper fittings with openings machined to accurate capillary fit for the pipe. Pipe to conform to Standard Specifications for copper water tube. Type ‘M’ may only be used for A/C condensate drain lines.

2. Use "lead free" (0.00% lead content) solder for all domestic water piping. Submittal on the product to be used must include this information. Lead free solder to conform to ASTM B 32 and flux to conform to ASTM B 813. Soldered joints must be done in accordance with ASTM B 828. Lead free shall mean a chemical composition equal to or less than 0.2 percent lead.

3. Solder joints using 50/50 lead tin solder for systems operating below 180^{O} F.

4. Solder joints using 430 silver solder for systems operating at 180^{O} F. or above.

5. Press fit joints using Viega, Apollo or equal press fit fittings.

C. Domestic Copper Pipe (2" and larger): (Contractor Option)

1. Copper tubing systems from two inches (2") through six inches (6") shall be installed using mechanical pipe couplings of a bolted type with a central cavity design pressure-responsive gasket along with grooved end copper fittings.

2. All copper tubing shall be prepared in accordance with the manufacturer's published specifications.

3. Couplings - Coupling for copper shall consist of cast ductile iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design, with nuts and bolts to secure unit together.

   a. Housings - Shall be cast of ductile iron conforming to ASTM A-536 (Grade 65-45-12) with a copper alkyd enamel paint coating.

   b. Gasket - Gaskets shall be molded of synthetic rubber in a central cavity, pressure-responsive configuration conforming to the copper tube size (CTS) outside diameter and coupling housing, of elastomers having properties as designated in ASTM D-2000.

   c. Water Service - Gaskets supplied for water services from -30^{O} F to +230^{O} F shall be a Grade "E" EPDM compound, with copper color code, molded of materials conforming to ASTM D-2000, designation 2CA615A15B44F17Z, recommended for hot water service within the specified temperature range.

4. Flanged Connections: Shall be engaging directly into roll grooved copper tube and fittings and bolting directly to ANSI Class 125 cast iron and Class 150 steel flanged components; installer to supply standard flange bolts. Flange casting shall be as in 3, a. above with a corresponding gasket as in 3, b.

5. Fittings - Fittings shall be full flow copper fittings with grooves designed to accept grooved end couplings.

   a. Standard fittings shall be two inch (2") through four inch (4") copper per ASTM B-75 alloy C12200; five inch (5") through six inch (6") bronze sand castings per ASTM B-584-87 copper alloy CDA 844 (81-3-7-9).

6. Butterfly Valves – Lug style, grooved end butterfly valves are to be rated for bi-directional dead end service to the full working pressure of the valve with the down stream flange removed.

   a. 2 ½-6" valves shall have either lever lock handles or gear operators. Valves in 2 ½" or 3" sizes may have two-position handle as per service requirements and manufacturer's recommendations.

      1) Valve housing shall be bronze per CDA-836 (85-5-5-5).

2) Disc shall be aluminum bronze or ductile iron.

3) Operator bracket shall be steel-black enamel coated.

4) Operator - Two (2) position detent or manual lever lock shall be steel-black enamel coated.

5) Seat to be molded to the body of the valve for bi-directional dead end service

7. Tube Preparation: Copper tube shall be ASTM B-88 (drawn tubing) and prepared in accordance with the latest published manufacturer's specifications, as applicable. Pressure ratings and end loads for roll grooved copper tubing are based upon test on copper tube prepared in accordance with manufacturer's specifications using manufacturer's approved rolled grooving tool for grooving copper tube.

8. Assembly: Couplings, fittings, adapters and tubing shall be assembled in accordance with the latest published instructions from the manufacturer for the particular product installed.

9. Reference hanger spacing in specification. In addition, use the following recommendations for support installation:

a. Copper tubing joined with grooved type couplings requires support to carry the weight of tubing and equipment. The support or hanging method must be such as to eliminate undue stresses on joints, tubing and other components.

b. The support system for mechanical grooved type tubing couplings must consider some of the special requirements of these couplings.

D. Compressed Air Piping:

1. Piping to be Schedule 40 black steel pipe. All piping 2" and smaller may be TYPE "K" hard drawn copper pipe, at contractors' option.

2. Use capped tees at each joint facing up to allow for future connections. All connections to be made with tees facing up.

3. Slope all piping to drain. Provide drain leg at each low point with ball valve at bottom of drain leg for draining system. Drain leg to be approximately 7'-6" A.F.F. (verify in field).

4. Install Metal-Flex flexible connector near compressor outlet equal to Amber/Booth type SS-PM.

2.04 VALVES

A. Select valves of the best quality and type suited for the specific service and piping system used. Minimum working pressure rating 125 psig steam or 150 psig W.O.G. All valves on insulated lines to have extended handles to allow operation without disturbing insulation seal.

B. Manufacturer: Nibco, KITZ, Jenkins, Milwaukee, Stockham, Apollo or other recognized manufacturer of equal reliability.

C. Globe Valve 2" and Smaller: Teflon disc, bronze body, bronze trim.

D. Ball Valves 3" and Smaller: Brass or bronze body, virgin TFE seat rings, blow-out proof stem, reinforced thrust washer, ¼ turn full open/full close, FULL PORT, CSA-ULFM approval.

E. Globe Valve 2½" and Larger: Iron body, bronze trim, Buna-N disc, flanged, bronze disc hot water, Buna-N disc cold water.

F. Swing Check Valves 2" and Smaller: Bronze body, horizontal swing, Y-pattern, renewable disc.

G. **Butterfly Valves: Reference Section 2.03, C. above.**

H. Drain Valves: Hose end gate valve or gate valves with hose connection. Do not use sillcocks in lieu of drain valves.

I. Valves Specified Elsewhere: Provide special valves such as motor operated valves, relief valves, temperature regulating valves, etc., as specified under the individual system or as indicated on the drawings.

J. USE FULL PORT BALL VALVES RATED FOR SERVICE INTENDED FOR ALL ISOLATION VALVES THREE INCHES (3") AND SMALLER.

2.05 BALANCING VALVES

A. Provide balancing valves for all cooling and heating flows and at all pump discharge lines. Provide balancing valves for all potable hot/tempered water recirculation systems and at TMV's as required by manufacturer's written instructions.

B. Valves sized for maximum 1 pound pressure drop at design flow with valve wide open. Submit schedule of balancing valves indicating sizes, flow ranges and pressure drop curves.

C. Valves, rated at not less than 150 psi, furnished with three self-lubricating bronze or teflon-coated stainless steel bushings with shaft seals at each bushing; seals to be hard back resilient type and shall be field replaceable; discs shall be bronze, aluminum-bronze, or semi-steel with welded nickel edge.

D. Valves 4" and smaller insulated with removable foam polyurethane Dry Cap. Series 400.

E. On valves 2" and smaller, use Flow Set balancing valves system consisting of: 300 lb. rate flow measuring bronze body ball valve with integral venturi and temperature and pressure taps; flow setting 300 lb. butterfly valve assembly with stainless steel disc and Viton seats dual-core temperature/pressure test port and external lockable memory stop. Furnish valves with insulation sleeve for ease of access to temperature/pressure ports and to allow adjustments of valve handles without removing insulation. Manufacturer: FlowSet by Olympic Valve, Inc. At the Contractor's option, use Presso B-Plus balancing valves with extension handle and extension P/T plugs.

F. Manufacturers: DeZurik, Olympic Valve, Inc., Jenkins, Nibco, B & G, Hammond, Presso, Apollo or approved equal.

2.06 UNIONS

A. Provide unions adjacent to all tanks and equipment and where required for disconnect and maintenance of equipment.

B. Union for Steel Pipe: Ground joint malleable iron.

C. Union for Copper Pipe: All brass.

D. Union Between Dissimilar Metals: Dielectric Union designed and advertised to be unaffected by heat, cold or fluid in pipe. EPCO or approved equal.

2.07 MISCELLANEOUS

A. Escutcheons: Nickel or chrome plate with screws or springs for holding plate in position.

B. Automatic Air Vents: Hoffman #79, Marsh or equal.

C. Gaskets: Gaskets 1/16 inch thick for all pipe sizes 10 inches and smaller, and 1/8 inch thick for all pipe sizes 12 inches and larger. Gaskets to be ring type between raised face flanges and full face type between flat face flanges with punched bolt holes and pipe opening. Gasket material shall be suitable for the service intended and shall be installed as recommended by the manufacturer. Manufacturer: Crane, John-Manville, or equal.

D. Strainers: Cast iron or bronze body basket or wye type strainers provided with ½" valved drain and a ¼" air vent cock, unless the strainer design is devoid of air pockets. Strainers shall have removable cylindrical or conical screens of nickel, copper, or brass and suitable flanges or tappings to connect with the piping they serve. Strainers 2½" and larger shall be provided with flanged covers. The free area of each screen shall not be less than three (3) times the area of the strainer inlet and shall be suitable for the service intended. Manufacturers: Crane, McAlear, Sarco or Armstrong.

2.08 MECHANICAL SUPPORTING DEVICES

A. General:

1. Securely fasten all mechanical work to the structure to prevent hazard to human life and limb, and to prevent damage to products of construction under all conditions of operation.

B. Pipe Supports:

1. Single Pipes:

a. Support all horizontal runs of steel, copper pipe under 2" and all cast-iron soil pipe on suitable hangers spaced not more than 5 feet on centers. Support all steel, and copper piping 2" and larger not more than 10 feet on centers. Support all PVC piping not more than 4 feet on center. Support piping in a manner to prevent binding, undue swing, and the transmission of vibration to the structure.

b. Support single pipes from clevis hangers equal to Anvil fig. 260. Install hangers for insulated piping outside the insulation using high density section of insulation and sheet metal shield or saddle. Provide copper plated hangers in contact with copper pipe.

2. Trapeze Hangers: Where pipes are clustered, parallel, and in same plane, they may be supported by trapeze hangers. Provide rods and angle-irons sized to suit load imposed. Minimum channel length to be six inches (6"); maximum rod spacing to be twenty-four inches (24") on center. Piping to be securely attached to trapeze hangers. Provide sheetmetal shield or saddle for all insulated piping running horizontally.

3. Piping on Walls: Secure with hook-plates, clips or fabricated steel brackets.

4. Supports from Steel Beams and Similar Construction: Use appropriate beam clamps.

5. Provide inserts for poured concrete and expansion bolts for pre-cast slabs.

6. Guide and anchor piping where necessary to control expansion and contraction. Provide supports and hangers with non-corrosive and rust-resistant finish. Galvanize or plate hanger rods after threading. Hangers other than those specified not permitted. **USE ONLY GALVANIZED HANGERS AND HANGER RODS FOR ALL PIPING IN CRAWL SPACE.**

7. Provide inserts for poured concrete and expansion bolts for pre-cast slabs. Use HiltiDrop-in Anchor or Kwik Bolt II Stud Anchor System. Verify allowable place of anchors with Structural Engineer.

8. Provide pipe supports according to the following schedule:

PIPE SIZE - INCHES	ROD SIZE - INCHES
½" through 2"	3/8"
2½" through 3"	1/2"
4" through 6"	5/8"
8" through 12"	3/4"

9. Manufacturers: Anvil International, C&P, Fee and Mason, Elcen or SuperStrut.

C. Support all piping on roof with pipe stands/roller equal to MIRO Industries Model 4-RAH-PC or Portable Pipe Hangers, Inc., Type PP10 with roller for piping 2-1/2" and smaller. For piping over 2-1/2", up to and including 8", use MIRO Industries Model 6-RAH-PC or Portable Pipe Hangers, Inc. (PPH) Type PS-1-2. All pipe stands to sit on walk board (coordinate type and methods of support with Roofing Contractor). Walk board to be a minimum of 3" larger on each side than support. Provide minimum pipe height above roof deck as required by jurisdiction having authority (at least 6"). Provide supports for piping under 2" at six feet on center. Provide supports for piping 2" and over at eight feet on center. **PIPE PROP will not be acceptable.**

D. Ductwork Support: Refer to Section 23 30 00-Air Distribution.

E. Inserts: Provide all inserts required for installation of horizontal piping. In poured concrete provide wrought steel or malleable iron and adjustable type. Where expansion bolts are necessary to secure piping or equipment, use malleable iron type with expansion case, to be inserted by drilling concrete. Power driven inserts not permitted for supporting piping to ceiling.

F. Miscellaneous Iron and Steel:

1. Provide all steel supports and hangers to support all equipment or materials unless noted otherwise.

2. All work shall be cut, assembled, welded and finished by skilled mechanics. Welds shall be ground smooth. Stands, brackets and framework shall be properly sized and rigidly constructed in a manner to withstand anticipated loads.

3. Measurements shall be taken on the job and worked out to suit adjoining and connecting work. All work shall be performed by experienced metal-working mechanics. Members shall be straight and true and accurately fitted.

4. Welded joints shall be ground smooth where exposed. Drilling, cutting and fitting shall be done as required to properly install the work and accommodate the work of other Trades.

5. Members shall be generally welded, except that bolting may be used for field assembly where welding would be impractical. Welders shall be skilled and certified.

6. All shop fabricated iron and steel work shall be cleaned and dried and given two (2) coats of weatherproof primer paint on all surfaces and in all openings and crevices.

2.09 ACCESS DOORS

A. Doors shall be Karp, Inland Steel Products, Milcor, Miami or Walsh-Hannon, constructed of steel with primer coat of rust inhibitive paint, and continuous piano hinge. Doors shall be key operated with flush operated cylinders, keyed alike. Key lock system shall be coordinated with the Owner and shall be approved by the Architect. Provide six (6) keys of type used for access panels for Owner's use. Obtain receipt of key delivery and submit to Architect for record.

1. Suspended Lath and Plaster Ceilings - Style: "M" with 16 gauge frame, 14 gauge panel.

2. Masonry Non-Rated Walls - Style: "M" with 16 gauge frame, 14 gauge panel.

3. Masonry Fire Rated Walls - Fire rated with UL, ½ hour "B" rating, 16 gauge frame, 20 gauge sandwich type insulated panel.

4. For access doors larger than 16" in either direction, provide two (2) locksets.

2.10 CHIMNEY SYSTEMS

A. Type B Vent:

1. Factory-built; labeled and tested for use with building heating equipment.

2. Double wall pipe; galvanized steel outer pipe, heavy gauge aluminum inner pipe.

3. Supply with support pieces, adapters, fittings, ventilating thimble and Type MC wind cap.

4. Provide vent and cap for all gas consuming equipment. Verify all sizes with actual equipment purchased. In no case shall the pipe be smaller than the equipment connection size.

B. Type “B” Vent Pipe Manufacturers: Metalfab, Metalabestos or equal.

C. PVC/CPVC Vent/inlet:

1. Provide minimum schedule 40 solid core PVC/CPVC combustion air intake and/or flue exhaust vent as required for all condensing type water heater(s)/furnace(s) installed and sized as required by manufacturer’s written instructions. Wrap all piping exposed to plenum spaces with products to meet 25/50 smoke/flame requirements. Terminate with products per manufacturer’s written instructions.

PART 3 - EXECUTION

3.01 EQUIPMENT MOUNTING

A. Provide equipment concrete pads, treated support runners, roof curb supports, mounting accessories, supports, hanger expansion joints, adapters and any other appurtenances to adapt fixtures and equipment supplied to the conditions of use.

B. Provide vibration eliminators as specified (if not specified elsewhere use vibration eliminators recommended by equipment manufacturer) at all pieces of equipment subject to vibration. (Exception; curb mounted equipment does not require vibration isolator rails except when specifically scheduled).

C. Independently support piping and ductwork at equipment so that no weight is supported by the equipment.

D. Securely fasten fixtures and equipment to the building structure in accordance with manufacturer's recommendation.

E. Provide steel base plates for floor mounted fixtures and equipment to distribute the weight so that the floor load is not more than 100 lbs. psf, unless special structural reinforcement is submitted for approval.

F. At wall attached fixtures and equipment weighing less than 50 pounds, provide backing plates of at least 1/8 x 10 inch sheet metal or 2 x 10 inch fire retardant treated wood securely built into the structural walls. Submit attachment details of heavier equipment for approval.

G. Electrical conduit shall not be hung from equipment or plumbing piping.

3.02 SLEEVES

A. Provide sleeves as required where pipes pass through walls, floors, or ceilings. Make sleeves as follows:

1. In non-fire rated bearing walls, foundations, masonry or concrete walls and floors, use schedule 40 black steel pipe.

2. In non-rated construction, use minimum 20 gauge galvanized sheetmetal.

3. In fire rated walls, floors and assemblies, install sleeves as required by UL System Number.

B. In non fire rated areas install sleeves flush with surfaces. In mechanical rooms or any wet floor where seepage may occur, install sleeve 1 inch above floor and caulk. Caulk both sides of penetration using UL listed one part firestop synthetic elastomer sealant, flexible at normal working temperatures, having smoke developed 50, fuel contributed 50, and flame spread 25 rating. Install thickness per manufacturer's recommendation. Manufacturer: Dow Corning FireStop 2000 Sealant, Flame Stop V, 3M: CP-25.

C. Waterproof all piping and sleeves through building exterior skin, including walls, roofs and interior floor penetrations to prevent leakage. Coordinate with the Architect on caulk material to use at exterior.

D. Size sleeves for cold piping to allow for continuous insulation through sleeve.

3.03 SEALING AND FIREPROOFING

A. SEALING OF PENETRATIONS THROUGH RATED WALLS, FLOORS, CEILING AND ROOF ASSEMBLIES SHALL BE INSTALLED PER UL "FIRE RESISTANCE DIRECTORY." UL SYSTEM NUMBERS INDICATED ARE FOR A PARTICULAR LISTED INSTALLATION AND ARE FOR GENERAL INFORMATION AND INTENT. OTHER LISTED UL SYSTEM DESIGNS MAY BE USED. IN ALL CASES, SUBMIT MATERIALS, UL SYSTEM DESIGN NUMBERS AND UL DETAILS TO BE USED THROUGHOUT THE PROJECT AND IDENTIFY WHICH DETAIL IS TO BE USED FOR EACH SPECIFIC CONDITION. POST REVIEWED DETAIL AT JOB SITE FOR REFERENCE.

1. Only materials tested in the specific UL System Number may be used.

a. Wrap Strip (UL System No. WL 5001): Nominal 1/4" thick by 2" wide intumescent elastomeric material. Manufacturer: 3M Type FS-195.

1) Use one (1) wrap strip for up to one inch (1") thickness insulation.

2) Use two (2) wrap strips for 1-1/2" inch and larger thickness insulation.

b. Caulk Manufacturer:

1) 3M Type CP-25 WB+ for all assemblies requiring 3M caulk.

2) For WL3045 and 3046 use Hilti FS611A Sealant.

c. Steel Sleeve (Stud Wall) (UL System 1003): Cylindrical sleeve shall be fabricated from minimum 0.019" thick (no. 28 gauge) galvanized sheet steel and having a minimum 2" lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall plus 1" such that, when installed, the ends of the sleeve will project approximately ½" beyond the surface of the wall on both sides of the wall assembly. The diameter of the openings cut on each side of the wall assembly (concentric with

pipe) to be 2 to 2-1/2" larger than the outside diameter of pipe, such that when the steel sleeve is installed, a 1 to 1-1/4" annular space will be present between the steel sleeve and the pipe around the entire circumference of the pipe. Install sleeve by coiling the sheet steel to a diameter smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum wallboard layers.

d. Steel Sleeve (Concrete or Block Wall): For cables, provide sleeve cast in floor/wall or mortared into CMU wall; optional sleeve for UL System No. CAJ1175.

e. Forming Material: Minimum one inch (1") thickness mineral-wool batt insulation material. Tightly pack into sleeve with minimum 1/2" recess on ends. Manufacturer: Thermafiber Safing Insulation.

2. Wire/Cables:

a. For Gypsum Frame Wall (Single Cable): Fireproof per UL System No. WL3001. Opening for cable to be hole-sawed through gypsum wall board layers. Diameter of opening to be 3/8" to 5/8" inch larger than outside diameter of cable. Cable to be rigidly supported on both sides of wall assembly. Caulk to fill annular space throughout thickness of gypsum wall board layers and apply 1/4" bead of caulk to perimeter of cable at its egress from wall (both sides).

b. For Gypsum Frame Wall (Multiple Cables): Use UL System No. WL3021, WL3045, WL3046 or equivalent to maintain rating of wall.

c. For Concrete Walls/Floors or CMU Walls (Single or Multiple Cables): Fireproof per UL System No. CAJ3030. Cables to be a minimum ten percent (10%), maximum thirty-three percent (33%) of cross-sectional area of opening. Recess minimum one inch (1") thickness of mineral wool material into opening around cables. Caulk openings around cable to minimum depth of one inch (1"). Optional sleeve may be used per UL detail requirements.

3. Firestop system shall be installed at top surface of floor and symmetrically on both sides of wall assemblies.

4. Materials used in firestop systems shall be installed in accordance with the manufacturer's instructions, provided with materials for specific UL System Number.

5. Reference Architectural for the exact location of all rated walls, floors, ceilings and ceiling/roof assemblies.

B. Manufacturers: 3M, Metacaulk, Hilti, BioFireshield, STI or equal.

C. In non-rated walls identified for sound insulation, provide 1/2" space between pipe and sleeve packed with multiple layers of forming material. Allow 5/8" minimum space on each side and caulk with acoustical sealant.

D. **Final condition to prevent passage of fire, smoke, noxious gas and water.**

E. For non-rated mechanical/electrical room walls: Seal all piping and ductwork passing through walls, floors and ceilings with 3M caulk, Type CP-25+.

F. Submit UL numbers and details for type of penetrations and materials to be used. All penetrations in fire rated walls, floors and ceilings must be installed per a UL listed detail specified for the application.

G. **Seal both sides of all floor penetrations into crawl space on both sides to prevent air and water migration.**

3.04 WATERPROOFING AND COUNTERFLASHING

A. Provide and install all counterflashing of all conduit, pipe or duct and equipment which penetrates roofs, walls and other weather barrier surfaces. Metal Roofing Contractor shall provide and install all curbs and counter flashing for all metal roof penetrations. Verify detail with Architect before installation.

B. All work shall be performed in a workmanlike manner to assure weatherproof installation. Any leaks developed shall be repaired at contractor's expense, to Architect's satisfaction.

C. Conduits, pipes or ducts passing through slabs shall have the sleeve extended above floors to retain any water and the space between the conduit, pipe or duct and sleeve caulked with lead wool. The top shall be sealed with lead and the bottom shall be sealed with monolastic caulking compound.

D. All waterproofing, flashing and counterflashing shall be provided and installed by the Roofing Contractor and shall be compatible with roofing system so as not to void any roof warranties. Confirm installation with Architect.

E. Slope all ducts to wall louvers to drain toward louvers. Provide continuous sleeve thru wall and seal all joints.

F. All piping and conduit penetrations through exterior walls shall be sealed on both side of drain plane and at exterior finished wall surface to prevent moisture intrusion.

3.05 LABELING AND TAGGING

A. Tag all valves with minimum 1/16" thick heat resistant laminated dark plastic labels engraved with readily legible white lettering 1/4" high indicating fluid in pipe and a "V" (valve) number (e.g. V-22). Securely fasten to the valve stem or bonnet with beaded chain. Provide an aluminum valve chart and frame with glass cover for typewritten valve chart. Install where directed. Coordinate valve numbers with mechanical contractor to avoid duplication. Refer to Section 20 00 00, and Manuals.

B. Label all equipment with minimum 1/16" thick heat resistant laminated plastic labels having engraved lettering 1/2" high and fastened in place with rivets, screws or adhesive backing. Example "WH-1, AHU-1, etc." If items are not specifically listed on the schedules, consult the Architect concerning designation to use. Refer to Section 20 00 00. Label all equipment served by emergency electrical panels with red labels.

C. Label all thermostats/sensors with minimum 1/16" thick heat resistant laminated plastic labels having engraved lettering 1/4" high and fastened in place with rivets, screws or adhesive backing. Label is to correspond to rooftop and/or air-handling units.

D. Provide access panel markers (minimum 1/16" thick laminated plastic type with engraved lettering) to indicate ceiling tile to be used for access for all A/C equipment, terminal units and plumbing shut-off valves. Use light green for plumbing and light blue for A/C equipment. Label to be attached to ceiling grid with rivets, screws or adhesive backing. Example, "AHU-3A" access. Plastic Label shall not be larger than the surface it is affixed to. IE. Shall not overhang grid or flange.

E. Manufacturer: Seton Pipe Marking Products, MSI (Marketing Services, Inc.) or equal.

3.06 TYPICAL PIPING

A. Provide insulating couplings or unions to prevent electrolysis between dissimilar metals when use of dissimilar metals cannot be avoided in one system.

B. Close all openings in pipes with appropriate caps, plugs, or covers during storage and progress of the work to preclude introduction of contaminants.

C. Arrange systems and locate valves so that either entire system or separate sections thereof may be drained for service. All service valves located no more than 24 inches above the ceiling and normally accessible from an 8 foot ladder.

D. Provide valves and unions adjacent to all tanks, batteries of plumbing fixtures and equipment, for disconnect purposes. Install all valves with stems vertical wherever possible, and in no case with stems below the horizontal.

E. Ream ends of all pipe to full diameter.

F. Provide pipe anchors, swing joints, and expansion compensators as required to control the expansion of pipelines.

G. Reduce pipe sizes using reducing tees or reducing fittings. Bushings not permitted except on tanks and similar equipment.

H. Provide escutcheons on all pipes passing through walls, floors, and ceilings in finished areas where piping is in counters, closets or cabinets, and subject to view when doors are open. Cover the pipe sleeve and secure plate in position.

I. Install hangers at each change in direction, and within 2 feet at each elbow or tee. This requirement is mandatory.

J. Pipe hooks, wire, chains or perforated metal shall not be used for pipe supports.

K. Insulate hangers for copper pipe from piping with at least two layers of 12 mil Polyken 826 corrosion control tape.

L. Install piping not to interfere with removal of equipment, ducts and devices or block access to door or access openings.

M. Piping serving plumbing fixtures and equipment shall be securely supported near the point where pipes penetrate the finished wall.

N. Test all piping in accordance with accepted trade standards if not specified elsewhere.

3.07 THREADED PIPE

A. Cut all threads true and of depth to make up properly without leaks.

B. Make connections to show at least two threads and not more than four threads when tight.

C. Make up joints with Teflon tape only as recommended by tape manufacturer, or as specified in specific piping sections.

3.08 AUTOMATIC (MANUAL) AIR VENTS

A. Install at highest point of chilled and hot water system, at chilled and hot water coils and at points necessary to relieve air in piping. Provide shut-off valve to facilitate maintenance of air vent.

B. Route 1/4" copper line from discharge of air vent to floor drain in mechanical room. Slope to drain.

3.09 PAINTING AND CODING

A. Ductwork and Piping: Prime and paint all exposed angle braces, hanger rods or straps, damper rods, and quadrants with one coat aluminum paint after removing scale and rust. Prime and paint ductwork and piping exposed in finished rooms to match room finish. Prime and paint <u>all</u> black iron piping located outdoors or otherwise exposed to weather. Coordinate painting and color with Architectural

paint specified elsewhere. All painting done by persons regularly employed at and skilled in that trade.

B. Grilles, Registers, Etc.: Furnish all grilles, registers, etc., other than extruded aluminum or plastic, with prime coat paint by manufacturer. Furnish all ceiling grilles, registers and diffusers with factory applied baked enamel to match ceiling tile. Paint all ductwork and/or conduit visible through registers, grilles and other openings with one coat of flat black paint to a point four feet (4') from opening on straight duct or around bend, whichever applies.

C. Pipe Coding:

1. Identify piping with pressure-sensitive coded pipe marker at piping adjacent to equipment, at intervals along all piping not to exceed 20' and at points where piping disappears into or emerges from floors, walls or ceiling. Secure both ends of marker with pressure sensitive tape with flow arrow on roll to indicate flow direction. Color code pipe markers and arrows indicating the liquid and/or use of the pipe.

2. Code piping to the following schedule: (SUBMIT ALTERNATE CODING)

Cold Water	CW
Hot Water	HW
Hot Water Circulating	HWC
Gas	FUEL GAS
Sprinkler	SPKR
Condensate	Condensate
Tempered Water	T

3. Manufacturers: Seton Pipe Marking Products, MSI or equal.

END OF SECTION

SECTION 20 07 00 - INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description:

1. This section describes specific requirements, products and methods of execution which relate to the insulation of ducts, pipes and other surfaces of the mechanical installation.

2. Insulation is provided for the following purposes:

a. Energy conservation

b. Control of condensation

c. Safety of operating personnel

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

C. Acoustical Lining Insulation Summary

1. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for correct fabrication and installation of air duct systems of sheet metal lined with fibrous glass duct liner, in accordance with applicable project drawings and specifications, subject to terms and conditions of the contract:

2. All air duct systems operating at internal air velocities not exceeding rated duct liner limitations as listed below and internal air temperature not exceeding 250°F (121°C).

3. Duct liner products shall conform to the requirements of ASTM C1071. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

4. The manufacturer’s product identification shall appear on the air stream surface.

5. Duct liner adhesive shall conform to the requirements of ASTM C 916. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

6. The finished duct system shall meet the requirements of NFPA 90A and 90B.

7. Duct dimensions shown on the plans are finished inside dimensions.

8. Fabrication and installation shall conform to the requirements of the latest edition of the North American Insulation Manufacturers Association's *Fibrous Glass Duct Liner Standard* (hereinafter referred to as NAIMA FGDLS) or the Sheet Metal and Air Conditioning Contractors National Association *HVAC Duct Construction Standards - Metal and Flexible* (hereinafter referred to as SMACNA HVAC DCS) or the manufacturer’s recommendations.

D. References

1. American Society of Testing and Materials(ASTM)
    a. ASTM C1071
    b. ASTM C916
    c. ASTM G21
    d. ASTM G22
    e. ASTM C423
    f. ASTM C518
2. National Fire Protection Association (NFPA)
    a. NFPA 90A
    b. NFPA 90B
    c. NFPA 259
3. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
    a. HVAC Duct Construction Standards Metal and Flexible (HVAC DCS)
4. North American Insulation Manufacturers Association (NAIMA)
    a. Fibrous Glass Duct Liner Standard (FGDLS)
5. International Nonwovens & Disposables Association (INDA)
    a. IST 80.6

E. Delivery, Storage and Handling

1. Deliver all materials and/or fabricated insulated duct sections and fittings to the job site and store in a safe, dry place.
2. Protect materials from dust, dirt, moisture, and physical abuse before and during installation, startup and commissioning. Wet or contaminated duct liner shall be replaced.

PART 2 - PRODUCTS

2.01 FIRE RATING OF MATERIALS

A. Provide all insulation products used above ground in buildings with burning characteristics not to exceed the following ratings according to NFPA 255-1972 "Method of Test of Surface Burning Characteristics of Building Materials": Flame Spread 25, Fuel Contributed 50, Smoke Developed 50.

B. Insulation specified for use underground and above ground away from the building, might have other burning characteristics. Use such products only where specifically required.

2.02 INSULATION

A. TYPE "A": Pre-molded Fiberglass Piping Insulation:

1. Jacketed Type:

a. Thermal conductivity K = 0.24 at 100^{O} F. mean temperature.

b. Factory applied kraft-reinforced vapor barrier flame retardant all service jacket and tape, with permeability rating - 0.02 perms. All service jacket with polymer film exterior surface that is smooth, durable, cleanable, wrinkle resistant, resists water staining and that does not support mold or mildew growth.

c. Provide insulation sections with self-sealing pressure sensitive adhesive on both overlap seam and mating jacket surface.

d. Fitting insulated with pre-cut insulation inserts covered with PVC fitting cover properly vapor sealed.

e. Manufacturer: Owens-Corning Fiberglass SSL II with ASJ Max or equal product by: Knauf (**NO MANSON**) or Manville with WMP-ASJ jacket.

2. Secondary Jacket (This goes on over properly sealed standard WMP-ASJ jacketing) All piping run within unconditioned indoor spaces such as Mechanical Room and Crawl Space or ventilated attic spaces):

a. PVC jacket Shall be used in <u>all</u> mechanical/boiler rooms for all insulated piping to within two inches (2") of interior wall surface of mechanical/boiler rooms. This includes all satellite mechanical rooms containing air handlers.

b. One (1) piece “hinged” construction.

c. **Entire piping system in mechanical rooms is to be covered with high-impact, UV-resistant polyvinyl chloride jacketing with gloss white finish.** Properly seal all joints. Follow manufacturers written installation instructions.

d. ALL Fittings to be insulated with pre-cut insulation inserts and are to be covered with PVC fitting cover.

e. All piping in Unconditioned spaces other than mechanical rooms are to be wrapped with mold resistant Polyguard ZERO-PERM vapor barrier membrane. Properly seal all joints. Follow manufacturers written installation instructions.

B. TYPE "B": Cellular Piping Insulation:

1. Thermal conductivity K = .27 @ 75^{O} F. mean temperature.

2. Elastomeric thermal insulation with permeability rating of .17 perms and Microban antimicrobial protection against mold growth.

3. Temperature range from -40^{O} F to 220^{O} F.

4. Insulation to meet 25/50 requirements for use in return air plenums.

5. Wall thickness as listed in Part 3 of this Section for size and use of piping.

6. Install without slit when possible. All slits in insulation to be smooth. Insulation installed with jagged edges will be removed and replaced at no cost to Owner.

7. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

8. When used on chilled water piping up to 6" diameter use Armacell AP Armaflex Black LapSeal tube insulation. On larger piping and vessels use AP Armaflex FS. Use only factory supplied/approved adhesives.

9. Manufacturers: Armacell Armaflex Type AP Pipe Insulation or equal by Aerocell or K-Flex.

C. TYPE "C": Blanket Type Duct Wrap Fiberglass Insulation:

1. **The Contractor may use a 3/4, 1 or 1-1/2 pound density product with a minimum installed R-value of 6.0 if ductwork is within building insulation envelope or minimum R-value of 8.0 if installed outside of building insulation envelope.** Density, thickness and installed R-value to be clearly indicated on submittal.

2. Fiberglass duct wrap insulation is to have a factory FSK or FRK facing which acts as the vapor barrier. Maximum permeability rating is 0.02 perms.

3. Use only labeled Type UL181AP Aluminum Foil Tape a minimum of 3" wide and 7.4 mils thick "Venture Tape #1525CW" or "Shurtape #AF-982"). Maintain a complete vapor barrier throughout all ductwork insulation applications. Use spreader to completely seal tape to all joints or tears in vapor barrier, surface must be clean prior to installation.

4. Certainteed SoftTouch Duct Wrap with FSK facing or equal. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

5. Manufacturers: Knauf, Schuller/Manville, Certainteed or Owens-Corning.

D. TYPE "D": Rigid Fiberglass Board Insulation (DUCTBOARD SYSTEM)

1. 1-1/2" thick, Type 475 with a minimum R-value of 6.0 when inside building insulation envelope.

2. 2" thick, Type 800 with a minimum R-value of 8.0 when outside building insulation envelope.

3. Rigid board composed of resin bonded glass fibers faced with reinforced foil vapor barrier with permeability rating of .02 perms.

4. Meet UL181 test and classified as Class I Air Duct. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

5. Maximum operating temperature of 250^{O} F.

6. Tape joints using heavy duty foil tape, UL181A labeled, 7.5 mils thick, 3 inches wide, FSK Facing Tape Venture or equal.

7. Manufacturers: Certainteed, Knauf, Schuller/Manville, Owens-Corning.

E. TYPE "E": Semi-rigid Fiberglass Insulation Board.

1. Semi-rigid glass fiber bonded insulation not affected by moisture, resistant to fungi and bacteria. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

2. Permit expansion and contraction of metal without cracking or shrinking.

3. Maximum operation temperatures of 850^{O} F.

4. Manufacturers: Certainteed 850 Fiberglass Insulation, Knauf, Schuller/Manville, Owens-Corning.

F. TYPE "F": FIRE RESISTIVE DUCT WRAP

1. Work of this section includes labor, material and equipment to provide 2 hour, fire resistive rated grease or air duct enclosure as a shaft alternative and a method for providing zero inch clearances around commercial kitchen grease duct exhaust systems to combustible materials.

2. Lightweight flexible refractory ceramic fiber blanket encapsulated with aluminum foil scrim. Nominal 1 ½" thick, 9 PCF.

3. UL Classified, double layer, fireproof, flexible, 2 hr. rated enclosed assembly with offset seams and stainless steel bands as required to meet 2 hr requirement.

4. Zero clearance to combustibles.

5. Use in combination with 3M Fire Barrier, 2000+ silicone sealant.

6. 3M, UL system V-17. Install as listed.

7. Manufacturer: 3M FireMaster Fast Wrap or equal by Unifrax Fyrewrap or Pyroscrat as approved by local AHJ.

G. TYPE "G": Cellular Elastomeric Foam Duct Liner:

1. Thermal conductivity K = .27 @ 75^{O} F. mean temperature.

2. Elastomeric thermal insulation with permeability rating of .17 perms.

3. Temperature range from -40^{O} F to 220^{O} F.

4. Insulation to meet 25/50 requirements for use in return air plenums.

5. Minimum R-value of 6.0 for one and one-half (1-1/2") thickness. Installed R-value to be a minimum of 6.0 inside building envelope. Minimum R-8 for ducts located outside the building insulation envelope.

6. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

7. Manufacturers: Armacell Armaflex AP or Armacell Coilflex elastomeric foam duct liner with Microban.

H. TYPE "H": Pre-molded Isoline Phenolic Foam Piping Insulation :

1. Jacket Type:

a. Thermal conductivity K = 0.24 at 100^{O} F. mean temperature.

b. Factory applied kraft-reinforced vapor barrier flame retardant all service jacket and tape, with permeability rating - 0.02 perms. WMP-ASJ All service jacket with polymer film exterior surface that is smooth, durable, cleanable, wrinkle resistant, resists water staining and that does not support mold or mildew growth.

c. Provide insulation sections with self-sealing pressure sensitive adhesive on both overlap seam and mating jacket surface.

d. Fitting insulated with pre-cut insulation inserts covered with PVC fitting cover properly vapor sealed.

e. Manufacturer: Owens-Corning Fiberglass SSL II with ASJ Max or equal product by: Knauf (**NO MANSON**) or Manville with equal jacket.

2. Secondary Jacket (This goes on over properly sealed standard WMP-ASJ jacketing) All piping run within unconditioned indoor spaces such as Mechanical Room and Crawl Space or ventilated attic spaces):

a. PVC jacket Shall be used in all mechanical/boiler rooms for all insulated piping to within two inches (2") of interior wall surface of mechanical/boiler rooms. This includes all satellite mechanical rooms containing air handlers.

b. One (1) piece “hinged” construction.

c. **Entire piping system in mechanical rooms is to be covered with high-impact, UV-resistant polyvinyl chloride jacketing with gloss white finish.** Properly seal all joints. Follow manufacturers written installation instructions.

d. ALL Fittings to be insulated with pre-cut insulation inserts and are to be covered with PVC fitting cover.

e. All piping in Unconditioned spaces other than mechanical rooms are to be wrapped with mold resistant Polyguard ZERO-PERM vapor barrier membrane. Properly seal all joints. Follow manufacturers written installation instructions.

2.03 SOUND CONTROL

A. Lined Duct:

1. Provide acoustically lined duct to attenuate and control the transfer of airborne sound and as duct insulation only when specifically indicated.

2. Lining: Flexible fiberglass blanket type mat faced insulation with durable surface coating, bonded with thermosetting resin. Maximum flame spread index; 25. Maximum smoke developed index; 50. **Lining to have anti-microbial coating.** Minimum R-value of 6.0 for one and one-half (1-1/2") thickness. Installed R-value to be a minimum of 6.0. **1.5" thick, R-6 lining equal to CertainTeed ToughGard R-EP or ToughGard2 Textile Duct Liner.** R-8 for ducts located outside the building insulation envelope. **ALL INSULATION IS TO BE FREE OF UREA-FORMALDEHYDE AND/OR BE GREENGUARD CERTIFIED.**

3. Air Friction Correction Factor 1.12 at 500 fpm or less.

4. Minimum sound absorption co-efficients as follows:

Thickness	Frequency					
	125	250	500	1000	2000	4000
1-1/2"	.17	.53	.87	.99	1.00	.95

5. All duct dimensions shown on drawings are net clear inside dimensions with duct liner. Install liner in compliance with requirements of NFPA 90A.

6. Manufacturers: Shuller, CertainTeed, Knauf or Owens-Corning.

7. All duct liner to be provided with tough abrasion resistant interior air side finish and antimicrobial coating.

2.04 INSULATED FITTING COVERS AND JACKETING

A. High-impact, UV-resistant polyvinyl chloride jacketing with gloss white finish.

B. Pre-cut curled jacketing, 30 mil. thickness. Sized to snugly fit pipe diameter with thickness of insulation specified.

C. Joints and seams sealed with Perma-Weld Adhesive to form a complete vapor barrier for chilled water and domestic cold water systems. Use tack and tape for heating water and domestic hot water systems. Installation of adhesives, tacks and tape shall be per manufacturer's recommendations. Submit installation instructions with submittal of materials.

D. Fitting Covers: Covers shall be pre-formed for fitting shape.

E. Manufacturer: Manville Zeston 2000 or Proto.

2.05 CANVAS JACKETING

A. Insulating Lagging Canvas: 8oz./sq. ft. minimum, 28 threads per inch minimum, Osnaberg or equal.

B. Lagging Adhesive: Plastic synthetic resin emulsion adhesive; watertight, mildew resistant, fire retardant; Miracle LA69, Borden Aerosol or equal. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

2.06 METAL OR VINALUM JACKETING

A. Material shall be minimum .016" thick aluminum jacket or vinalum .020" thick aluminum faced PVC jacket with integral factory applied vapor barrier.

B. Elbows, fitting and valves shall be metal preformed fitting covers (no gores acceptable). Valves made from .020 metal. All valves ends and where insulation reduces, shall have Pittsburgh seams.

1. All straight line metal to be Z-locked jacket held in place with 3/4" wide aluminum bands at nine inches (9") on center with wing seals.

C. All joints and seams shall be watertight with Childers CP-76 OR Foster 95-44.

D. Manufacturer: "Strap-On" Childer Cawed Systems or equal.

2.07 COATINGS

A. All coating to bear the UL label. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

B. On cold or dual service lines, use vapor barrier type coatings.

2.08 METAL SHIELDS (SADDLES)

A. Metal Shields curved to fit up to midpoint of the insulated pipe.

B. Metal shields shall be 16 gauge, twelve inches (12") long for pipes up to two inches (2"), 14 gauge, eighteen inches (18") long for piping 2-1/2" to 4", twenty four inches (24") long for piping 5" to 6", 14 gauge, thirty inches (30") long for piping over 6".

C. Provide rigid insulation for entire length of saddle plus 4" (2" at each end) to properly support piping. All piping support to be on exterior of insulation.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION AND WORKING CONDITIONS

A. Apply all insulation, fitting covers, mastics and sealants per manufacturer's recommendations.

B. Do not apply insulation materials until all surfaces to be covered are clean and dry and all foreign materials such as rust, dirt, etc., are removed.

C. Keep insulation clean and dry during installation and during the application of any finish.

D. Do not install the insulation on pipe fittings, and pipe joints until the piping is tested and approved.

E. Do not apply under conditions of excessive humidity or at temperatures below 50^{O} F or above 100^{O} F.

3.02 TECHNIQUE FOR APPLICATION TO PIPES

A. Close longitudinal joints of pipe insulation firmly and butt insulation sections firmly together.

B. Neatly and smoothly adhere all laps and butt strips. Adhere three inch (3") wide self-sealing butt joint strips over end joints.

C. Replace all insulation having loose joints or laps. Sloppy work will not be acceptable and such work shall be removed and re-applied.

D. Provide ½" over the thickness of insulation specified at all insulated piping in outside walls.

E. Where insulation with a vapor barrier terminates, it shall be sealed with "Ductmate Protack". Ends shall not be left raw.

F. On water piping use sheet metal shields outside the insulation at hanger locations. In addition, provide:

1. A molded vegetable cork or foam glass insert not less than twelve inches (12") long of same thickness and contour as insulation between support shield and piping and under the finish jacket.

2. Heavy density insulation minimum six (6) pounds per cubic foot under entire length of metal shield.

G. Where piping and fittings are installed out of doors, provide vapor barrier jacket, cover with metal or vinalum jacket with seams located on bottom side of horizontal piping.

3.03 TECHNIQUE FOR APPLICATION TO PIPE FITTINGS, UNIONS AND VALVES

A. On insulated piping with vapor barrier, insulate fittings, unions, valves and flanges including Victaulic and Gustin-Bacon to the same thickness as the pipe insulation.

B. Any of the following methods of insulation is acceptable:

1. PVC Snap Form Fitting Covers: Wrap all valves and fittings with precut fiberglass insulation wraparound inserts. Brush vapor barrier mastic on adjoining section of pipe insulation and on overlapping edges of jacket and throat seam before applying preformed fitting. Secure cover with stainless steel tacks. Tape joints with pressure sensitive vapor barrier tape.

3.04 TECHNIQUE FOR APPLICATION TO DUCTWORK

A. Impaling Over Pins: Install all insulation with edges tightly butted. Impale insulation on pins welded to the duct and secure with speed clips. Trim off pins close to speed clip. Space pins as required to hold insulation firmly against duct surface, but not less than one pin per square foot. Seal all joints and speed clips with glass fabric set in adhesive. Provide metal angle at corners to protect edges of insulation.

B. Other Method of Securement: If the welded pin method is impossible, secure the insulation to the duct with “Ductmate Protack” or Childers CP-127 or Foster 85-60 adhesive. Cover the entire surface of the metal with adhesive when applying to the underside of horizontal ducts. Application to top and sides may be in strips with a minimum of 50% coverage. Additionally, secure insulation with No. 16 galvanized wire on not more than twelve inch (12") centers. Provide metal angle at corners to protect edges of insulation. Seal joints as above. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

C. Where external insulations terminate, seal insulation to ductwork with Childers CP-35 or Foster 30-65 with 3" glass fiber reinforcing mesh.

D. Impale rigid insulation board over pins. Provide two layers of glass cloth and four layers of weatherproof vapor barrier adhesive coating. Install .040 thick lock-formable aluminum jacket over sealed insulation. All joints are to be 1” standing seams. The top of the aluminum jacket is to slope a minimum of 1” in 12” to sides to prevent collection of water. Install tapered insulation under sloped top for support of aluminum jacket. Provide a minimum of 1” flange out at connection point to mechanical equipment and building to ensure that water does not get under jacket. Provide counterflashing that is appropriate for building material type. Coordinate with Architect to ensure a watertight connection to building.

3.05 EXAMINATION (LINED DUCTWORK)

A. Verify that the duct liner products are installed in accordance with project drawings, duct liner operating performance parameters and limitations, and provisions of NAIMA FGDLS or SMACNA HVAC DCS or manufacturer’s recommendations.

3.06 INSTALLATION (LINED DUCTWORK)

A. All portions of duct designated to receive duct liner shall be completely covered with duct liner. All joints shall be neatly butted and there shall be no interruptions or gaps. Duct liner shall be installed with the Printed air stream surface treatment exposed to the air stream.

B. Duct liner shall be adhered to the sheet metal with 90% (minimum) coverage of adhesive complying with the requirements of ASTM C 916. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

C. All transverse edges that are not to receive sheet metal nosing shall be coated. Longitudinal joints shall occur at the corners of ducts. If duct size and standard duct liner product dimensions make exposed longitudinal joints necessary, such joints shall be coated with adhesive designated for duct liner application and which meets the requirements of ASTM C 916. Such joints shall be additionally secured with mechanical fasteners in accordance with NAIMA FGDLS, or SMACNA HVAC DCS as if they were transverse joints.

D. Duct liner shall be additionally secured with mechanical fasteners complying with the requirements NAIMA FGDLS or SMACNA HVAC DCS and of the correct type for the duct liner being installed. Fasteners may be either weld-secured or impact-driven, and shall be installed perpendicular to the duct surface. Mechanical fasteners shall not compress the insulation more than 1/8" (3 mm) based on nominal insulation thickness. Fastener spacing with respect to interior duct dimensions shall be in accordance with NAIMA FGDLS or SMACNA HVAC DCS. Fastener heads or washers shall have a minimum area of 0.75 in^2 (484 mm^2), with beveled or cupped edges to prevent their cutting into the duct liner.

E. Where air velocities exceed 4000 fpm (20.3 m/sec), metal nosing (either channel or "zee" profile) shall be installed on upstream edges of liner duct sections.

F. Metal nosing shall be securely installed over transverse liner edges facing the airstream at fan discharge and at any point where lined duct is preceded by unlined duct.

G. Duct liner in roll form shall be folded and compressed in the corners of rectangular duct sections, or shall be cut and fit to assure a lapped, compressed corner joint

H. Duct liner in sheet form shall be cut and fit to assure tight, over-lapped corner joints. Top pieces of liner shall be supported at the edges by the side pieces

I. Any damage to the air stream surface must be repaired by coating the damaged area with adhesive or coating designed for duct liner application. Adhesive or coating shall meet requirements of ASTMC916.

3.07 FIELD QUALITY CONTROL (LINED DUCTWORK)

A. Upon completion of installation of lined duct and before HVAC system start-up, visually inspect the ductwork and verify that duct liner has been correctly installed. Confirm that the duct system is free from construction debris.

B. After the lined duct system is completely installed and ready for service, conduct a final inspection of the entire system. This inspection should include, at minimum, the following steps:

1. Check all registers, grilles, and diffusers to ensure that they are clean and free from construction debris.

2. Check all filters in accordance with their manufacturer's instructions. Use specified grade of filters at all times that system is operating.

3. Cover supply openings with filter media prior to system start-up to catch any loose material that may remain inside the ductwork.

4. Turn the HVAC system on and allow it to run until steady state operation is reached.

5. Remove the temporary filter media from supply openings and, along with it, any loose material blown downstream and caught by the filter media.

6. Check to ensure that air delivery performance meets all requirements and complies with SMACNA leakage specifications.

3.08 PROTECTION (LINED DUCTWORK)

A. Contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats and eye protection.

B. The contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

3.09 COLD PIPING INSULATION

A. Insulate piping for domestic cold water, rain leaders, from primary and overflow roof drains, using one inch (1") Type "A" or Type "B" Insulation.

B. Provide a complete vapor barrier throughout the entire system. Use only vapor barrier adhesives and coatings. Stapling of jacket not permitted. Penetrations in vapor barrier jacket, joints, and seams sealed vapor proof with Childers CP-35 or Foster 30-65 (white) mastic. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

C. Cover ends of insulation sections with an adhesive coating at intervals of not more than twenty feet (20'). Insulate accessories, valves, flanges, etc.

D. Cover insulation on fittings with spiral-wrapped glass mesh tape. Finish with a vapor barrier coating applied approximately 1/16" thick.

E. Insulate all horizontal runs at primary and overflow roof drain rain leader piping from bottom of roof deck to include roof drain body, to one foot (1') past turn down fitting in vertical direction. Vertical rain leaders need not be insulated when concealed, routed inside wall cavity.

F. Insulate all cold water piping above ceiling to point where piping turns down into chase. When piping turns down into exterior walls, piping in exterior walls must be insulated.

3.10 HOT & TEMPERED PIPING INSULATION

A. Insulate domestic hot and tempered water and circulating lines using one inch (1") Type "A" insulation one inch (1") thickness for ½" to one inch (1") piping, 1-1/2" thickness for 1-1/4" to two inch (2") piping and two inch (2") thickness for 2-1/2" to six inch (6") piping. Domestic hot water lines may be insulated with one inch (1") Type "B" insulation.

B. Staples may be used to seal jacket.

C. Insulate unions, valves and flanges in boiler room only for piping over 140^{O} F. Insulate with same method used for cold pipe fittings, except vapor barrier mastic is not required.

D. Do not insulate valves, flanges, and unions for domestic hot water piping systems below 140^{O} F., but bevel and seal ends of insulation at such locations.

E. Insulate hot water expansion tank and air separators with one inch (1") sheet type "B" insulation.

3.11 SPECIAL PIPING INSULATION REQUIREMENTS

A. Insulate buried domestic hot and cold water lines under building with one inch (1") Type "B" Insulation. Bond joints using an adhesive; apply surface treatment as recommended by insulation manufacturer, taping not permitted. Set in sand bed and cover with minimum five inches (5") sand. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

B. **Insulate all refrigerant piping for heat pump systems and suction lines only for all other systems with Type "B" Insulation:** ½" thickness for piping up to 1" and 3/4" thickness for piping larger than one inch (1"), apply per manufacturer's recommendations. Glue all joints and seams with Armaflex 520 Adhesive BLV LOW VOC. Protect all insulation on piping outside with two (2) coats of "WH" Armaflex Finish Coating for weather protection. No tape is allowed. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

C. Insulate all exposed p-traps and water connections for handicapped lavatories with White "Truebro Handi Lav-Guard" Insulation Kit Model #102W (Use Model #105W when 5" offset strainer is used). (Phone: 203-875-2868), or equal products as manufactured by Brocar Products Inc., (Phone: 512-847-1524).

D. Insulate p-trap of all floor drains above the first floor and deep seal traps that receive condensate. Insulate with 3/4" thick Type "B" Insulation.

3.12 DUCT INSULATION REQUIREMENTS

A. Insulate Ducts as Follows:

1. Thickness and Type:

a. Exhaust Air and Outside Air Exhaust Ducts: Externally wrap with Type "C" Insulation; insulate from roof deck/wall exterior back three feet (3') into space. (R-6)

b. Rooftop Units: Internally line rooftop unit supply and return air drops past first ninety degree elbow, reference Specification Section 20 07 00, 2.03, Sound Control for Liner. Provide access door in duct risers for access and cleaning. Minimum size 18 x 18. (Exception: Rooftop unit serving kitchen is to have the supply air drop internally lined and the return air drop externally wrapped with Type "C" Insulation.). R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.

c. Supply Air: Externally wrapped with Type "C" Insulation, unless specifically noted otherwise. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.

d. Return Air: Externally wrapped with Type "C" Insulation, unless specifically noted otherwise. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building envelope.

e. Outside Air: Supply ducts externally wrapped with Type "C" Insulation. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.

f. Relief Air: Externally wrap with Type "C" insulation when run through unconditioned spaced, unless specifically noted otherwise. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.

g. Air Devices: Externally wrap backs of all supply, return and exhaust air devices including square to round adapters and boots with Type "C" Insulation. Properly seal all edges. Use R-8 insulation for air devices with backs outside of building insulation envelope and R-6 insulation when backs of air devices are located inside building insulation envelope.

h. Grease Rated Kitchen Exhaust: Shall be installed in one (1) hour enclosure with minimum three inches (3") clear, maximum twelve inches (12") clear, reference Architectural. Coordinate access doors with enclosure. As an option to installing grease rated exhaust duct in a one (1) hour enclosure, insulate with Type "F" insulation installed to meet manufacturer's written instruction for this application.

i. Kitchen Supply: Type "C" or Type "D" Insulation. R-8 for ductwork located outside or in attic spaces and R-6 for all other ducts inside the building insulation envelope.

j. Exterior Ductwork: R-8 Type "E" and/or duct liner insulation.

k. Special circumstance as noted: R-6 or R-8 Type "G" duct liner insulation.

3.13 CONDENSATE PIPING INSULATION

A. Condensate piping to be insulated with Type "B" Insulation 1/2" thick. Entire condensate system to be insulated when copper pipe is used.

1. Apply per manufacturer's recommendations. Glue all joints and seams with Armaflex 520 BLV LOW VOC Adhesive. No tape will be allowed. Auxiliary condensate not required to be insulated. Protect all insulation on piping outside with two (2) coats of "WH" Armaflex Finish Coating for weather protection. **ALL ADHESIVES, SEALANTS AND COATINGS MUST MEET OR EXCEED GREEN BUILDING PROGRAM SCAQMD RULE 1168 AND 1113.**

END OF SECTION

SECTION 22 01 00 - INSIDE UTILITY TRENCH EXCAVATION, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes general requirements, products, and methods of execution relating to excavation, backfill and compaction of inside trenches for mechanical work. Inside trenches are those which occur within an arbitrary, imaginary boundary five feet beyond the outside perimeter of the structure.

B. Scope: Provide all trench work for mechanical work of every description and of whatever substance encountered to the depth indicated, or to provide pipe slopes and elevations shown on the drawings. Excavate and backfill utility trenches. Place and compact bedding material. Compact backfill material.

C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 APPLICABLE CODES

A. Local Codes and Ordinances

B. Texas Safety Standards

C. OSHA - Section 1926.650

1.03 SAFETY PRECAUTIONS AND PROGRAMS

A. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to enforce and comply with all of the provisions of this Act. IN ADDITION, ON PROJECTS IN WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.

PART 2 - BEDDING MATERIAL

2.01 BEDDING MATERIAL

A. Select bedding material from trench excavation using care to separate it from unsuitable material. If suitable bedding material is not available from trench excavation, import it from sources approved by the Architect.

B. Use clean sand. Maintain moisture content within a range that will allow specified compaction.

2.02 TRENCH BACKFILL

A. Obtain trench backfill material from trench excavation. If sufficient suitable trench backfill material compatible with structural backfill is not available from trench excavation, import it from sources approved by the Architect.

B. Use granular material, free from large stones, boulders and debris. Maintain moisture content within a range that will allow specified compaction. Maximum aggregate size four inches (4").

PART 3 - EXECUTION

3.01 EXCAVATION

A. Place all excavated material suitable for backfill in an orderly manner, and in conformance with safety codes.

B. Dispose of all material not suitable for backfilling.

C. Form bell holes so pipelines rest on continuous undisturbed soil. If larger rocks or boulders are encountered, remove them. If trenches are below specified grade, backfill to required depth with select granular materials free from debris and rock, and compact to proper grade before installing piping.

D. Follow manufacturer's recommendations for minimum trench width, material type and cover requirements.

3.02 LOCATION

A. Locate trenches to accommodate utilities shown on the drawings.

B. Construct trench with adequate width to allow compaction equipment to be used at the sides of pipes.

C. Make trench side slopes conform to prevailing safety code requirements.

3.03 DEWATERING

A. Perform whatever work is necessary to prevent the flow and accumulation of surface or ground water in the excavation.

3.04 TIMING

A. Do not backfill until underground mechanical system has been properly tested, inspected and approved.

B. Coordinate with the work of others, and complete all trench work in a timely manner.

3.05 BEDDING

A. Place bedding material under, around, and over the pipe in lifts not exceeding 8" in depth.

B. Work material around pipe by hand methods, taking care to keep any oversize or sharp stones out of contact with the pipe, and to provide uniform support for the pipe.

C. Cover pipe with bedding material to building subgrade or to a minimum 12" depth before adding other backfill.

3.06 BACKFILLING

A. Continue placing backfill material until trench is completely filled to building subgrade, or as shown on the drawings.

B. Place backfill material in lifts not to exceed 12" in depth.

3.07 COMPACTION

A. Compact all bedding material to at least 95% of maximum density, taking care not to damage the pipe.

B. Compact all backfill under footings, slabs, and other structures to 95% of maximum density or more, if required by the Architect.

C. Compact other areas to preclude future settlement, or at least 85% of maximum density.

3.08 FINISHING

A. After completion of backfilling, dispose of excess material and smooth the surface to grade.

B. Do not allow heavy equipment to be used over backfilled work that does not have sufficient cover to prevent pipe damage.

3.09 SPECIAL PRECAUTIONS

A. Avoid unauthorized and unnecessary excavations.

B. Minimize number and size of excavations under footings or bearing walls.

C. Support footings, foundations, and walls with timbers and jacks if there appears to be any possible chance of damage, and keep such precautions in place to eliminate possible damage.

D. Backfill under footings and bearing walls, using maximum compaction or concrete of proportions as specified for footings.

E. Avoid damage to all existing underground services, foundations, cables, conduit lines or foundations. Repair any existing underground work accidentally damaged at no additional cost to the Owner.

3.10 UNDER EXISTING SLAB INSTALLATION

A. When breaking out an existing floor slab, make a saw cut and remove concrete. When repouring concrete, compact the fill to the same specifications as the building fill. Re: Architectural/Structural. General Contractor to make necessary saw cuts and patching as required. **Coordinate penetrations of existing grade beams with structural engineer.**

END OF SECTION

SECTION 22 02 00 - OUTSIDE UTILITY TRENCH EXCAVATION, BACKFILL AND COMPACTION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Related Work Specified Elsewhere:

1. Section 20 00 00 - General Provisions

2. Section 20 01 00 - Basic Materials and Methods

3. Division 2 - Site Work

B. Description: This section described general requirements, products, and methods of execution relating to excavation, backfill, and compaction of utility trenches outside of buildings. The arbitrary line of demarcation between inside and outside of buildings occurs 5' outside the building perimeter.

C. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.

D. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 - PRODUCTS

2.01 BEDDING MATERIAL

A. Select bedding material from trench excavation using care to separate it from unsuitable material. If suitable bedding material is not available from trench excavation, import it from sources approved by the Architect.

B. Use granular material, free from large stones, boulders and debris. Maximum aggregate size passing a 2" sieve opening. Maintain moisture content within a range that will allow specified compaction.

2.02 TRENCH BACKFILL

A. Obtain trench backfill material from trench excavation. If sufficient suitable trench backfill material is not available from trench excavation, import it from sources approved by the Architect.

B. Use granular material, free from large stones, boulders and debris. Maintain moisture content within a range that will allow specified compaction. Maximum aggregate size 4 inches.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Excavate trenches to depth and grades as shown on drawings.

B. Place all excavated material suitable for backfill in an orderly manner and in conformance with safety codes.

C. Dispose of all material not suitable for backfilling.

D. Form bell holes so pipelines rest on continuous undisturbed soil. If larger rocks or boulders are encountered, remove them. If ground surface is below specified pipe grade, fill to required depth with granular materials free from debris and rock, and compact to proper grade before installing piping.

3.02 LOCATION

A. Locate trenches to accommodate utilities shown on the drawings.

B. Construct trench with adequate width to allow compaction equipment to be used at the side of pipes.

C. Make trench side slopes conform to prevailing safety code requirements.

3.03 DE-WATERING

A. Perform whatever work is necessary to prevent flow and accumulation of surface or ground water in the excavation.

3.04 TIMING

A. Do not complete backfill until utility system has been properly tested, inspected, and approved.

B. Coordinate with the work of others and complete all trench work in a timely manner.

3.05 BEDDING

A. Place bedding material under, around, and over pipe in lifts not exceeding 8" in depth.

B. Work material around pipe by hand methods, taking care to keep any oversize or sharp stones out of contact with the pipe, and to provide uniform support for the pipe.

C. Cover pipe with bedding material to a minimum 6" depth before adding other backfill.

D. Cover water line with 18" bedding material before backfilling.

3.06 BACKFILLING

A. Continue placing backfill material until trench is completely filled to finished grade, or as shown on the drawing.

B. Place backfill material in lifts not to exceed 12" in depth.

3.07 COMPACTION

A. Compact all bedding material to at least 95% of maximum density, taking care not to damage the pipe.

B. Compact backfill material to preclude future settlement or at least to 90% of maximum density.

3.08 FINISHING

A. After completion of backfilling, dispose of excess material and smooth the surface to grade.

B. Restore all surface areas to original conditions, or improve as shown on the drawings. Replace all paving, base course, gravel surfacing, sub-base, topsoil or other existing finished surface as shown on drawings.

C. Clean up and finish all construction areas to original condition or better.

END OF SECTION

SECTION 22 11 16 - WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes specific requirements, products and methods of execution relating to the domestic water distribution system for the project.

B. The work of this section includes: All water distribution work inside the structure, and all outside distribution work up to and including connection to the water source, including provision of the outside water source, or water using apparatus, although the work of this section does include the interface connections at all of these related items.

C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 CONNECTION TO UTILITY WATER SYSTEM

A. Coordinate with site utilities to properly locate and interface with the water supply. Stub water 5'-0" outside the building and make connection to water supply. See Civil Drawing for site utility locations.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS ABOVE GROUND (INSIDE STRUCTURE)

A. Type "K" or "L" hard drawn copper tubing, wrought solder type fittings, lead free (0.00% lead content) solder or brazed or press fit joints by Viega or Apollo.

2.02 PIPING AND FITTINGS BELOW GROUND

A. 2" and Smaller:

1. Type “K” soft copper, wrought bronze solder type fittings, lead free (0.00% lead content) solder.

2. Use heavy duty Water-Tite-Sleeve as manufactured by IPS Corporation for all piping underslab. Sleeves for 1" and under shall be 25 mil., blue for cold water and red for hot water. Sleeves for 1 1/4" to 2" shall be 6 mil., black in color.

B. 2-1/2" and Larger:

1. Type “K” hard drawn copper, wrought bronze solder type fittings, lead free (0.00% lead content) solder.

C. No joint to be installed under building slab.

2.03 WATER METER

Reference Civil Drawings

PART 3 - EXECUTION

3.01 GENERAL METHODS

A. Make all joints in accordance with manufacturer's recommendations. The tools used shall be the tools adapted to that specific purpose.

B. At all fixtures, install and connect hot water on left and cold water on right, as viewed when facing the fixture.

C. Where required for connections to fixtures, equipment items, etc., employ lengths of red brass pipe with threaded ends of copper to IPS adapters, brass couplings, etc., to the end that there shall be no ferrous pipe in any water piping system.

D. Provide valves on each branch line at the point of connection into the supply and circulating mains serving all batteries of plumbing fixtures. Provide stop valves in each water supply for every plumbing fixture. Each hose bibb is to have an individual shut off valve, separate from valves that would shut down a battery of fixtures. Valves for piping two inches (2") and smaller shall be ball valves.

E. Provide water hammer arrestors with accessible isolation valve equal to Wade Shok-stops, JR Smith Hydrotrol 5000 Series, or Zurn Shocktrols Z1700 Series on cold water and hot water supplies to plumbing fixtures. Provide access door for all concealed arrestors. Shok-stops shall not be installed in the pendant position. **O-ring type arrestors are not considered equivalent. Arrestors are to be installed in locations and sized per Manufacturer's installation instructions.**

F. Install vacuum breakers on all plumbing lines where contamination of domestic water may occur and on boiler make-up lines and hose bibbs.

G. Insulate all exposed water connections for handicapped lavatories and sinks with "Handi Lav-Guard" Insulation Kit (Phone: 203-875-2868).

3.02 TESTING

A. Test all water piping hydrostatically at 150 psig or 150% of working pressure, whichever is greater, for a period of 24 hours. Observe piping during this period and repair all leaks. Test for lead, certify that lead residual in piping system does not exceed local code requirements.

3.03 STERILIZATION OF DOMESTIC WATER SYSTEMS

A. Sterilize each unit of completed supply line and distribution system with chlorine solution before acceptance for domestic operation.

B. Accomplish sterilization as described below or by the system prescribed by the American Water Works Association Standard C-601. Apply the amount of chlorine to provide a dosage of not less than 50 parts per million. Provide chlorine manufactured in conformance to the following standards:

1. Liquid Chlorine: Federal Specification BB-C-120.

2. Hypochlorite: Federal Specification 0-C-114a, Type 11, Grade B or Federal Specification 0-X-602.

C. Introduce the chlorinating material to the water lines and distribution system after piping system has been thoroughly flushed. After a contract period of not less than 24 hours, flush the system with clean water until the residual chlorine content is not greater than .2 parts per million.

D. Open and close all valves in the lines being sterilized several times during above chlorination.

E. The sterilization process shall be done by persons whose major business is water treatment and sterilization. The Plumbing Contractor shall pay all costs and charges associated to this test and certification.

F. Certify in writing that sterilization has been completed in accordance with these requirements.

END OF SECTION

SECTION 22 11 17 – WATER HEATERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section describes specific requirements, products and methods of execution relating to the domestic water distribution system for the project.

B. The work of this section includes: All water distribution work inside the structure, and all outside distribution work up to and including connection to the water source, including provision of the outside water source, or water using apparatus, although the work of this section does include the interface connections at all of these related items.

C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 – PRODUCTS

2.01 GAS WATER HEATER

A. The water heater shall be a sealed combustion system, taking only outside air for combustion and exhausting the flue gas with PVC Schedule 40 or 80 PVC pipe. Wrap both with material to maintain 25/50 in plenum application. Pipe size to match length requirements.

B. The heater as well as all related intake air and exhaust intake air and exhaust gas piping shall be approved for zero clearance to any combustible surface.

C. The heaters tank shall have seamless glass lined steel tank construction with glass lining applied to all water-side surfaces after the tank has been assembled and welded.

D. Heater to have modulating burner.

E. All heaters shall run at a combustion efficiency of up to 96% thermal efficiency. Meet the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition of ASHRAE/IESNA 90.1. Have foam insulation and a CSA Certified and ASME rated T&P relief valve. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up. Heater shall be supplied with maintenance-free powered anode. All heaters shall be approved in accordance with ANSI Z 21.10.3. All heaters shall be supplied with factory installed low water cutoff, and upper hot water sensor, and lower cold water sensor. All heaters shall be furnished with a factory installed condensate trap assembly ready for easy connection to a field supplied condensate drain.

F. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout.

G. The BTH-120-250 models are design-certified by CSA International, according to ANSI Z21.10.3-CSA 4.3 standards governing storage-type water heaters. The BTH-300-500 models are design-certified by Underwriter's Laboratories (UL), Inc. according to ANSI Z21.10.3-CSA 4.3 standards governing storage-type water heaters.

H. Meet the thermal efficiency and standby loss requirements of the U.S. Department of Energy and current edition ASHRAE/IESNA 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management Owners with similar requirements for low NOx emissions.

I. The heater shall be factory assembled; test fired for correct BTU input and adjusted for proper combustion parameters. Complete operating and installation instructions shall be furnished with every heater as packaged by the manufacturer with the heater for shipping.

J. Three year limited warranty on tank with one year on all other parts.

K. Manufacturer: A.O. Smith Cyclone MXiBTH Series, Lochnivar Shield or equal by State or Rheem.

2.02 WATER HEATER

A. Electric Water Heater:

1. Pre-wired, factory tested, NSF certified and with UL seal of approval.

2. Tank: Glass lined and ASME approved for 150 psi working pressure with a minimum of 2" of high density foam insulation; Anode rods for electrolytic protection and hand hole inspection port.

3. Thermostats are to be of the immersion type; one thermostat per each set of 3 elements.

4. The complete system to be protected by energy cut off switch in the event of an over temperature situation.

5. Manufacturer: State, PVI, A.O. Smith, Rheem or approved equal.

2.03 Provide an ASME rated temperature and pressure relief valve with drain piping to the nearest drain receptor for all water heaters. The temperature and pressure relief valve shall be labeled and shall be tested in accordance with ANSI Z21.22.

2.04 Provide heat traps on incoming and discharge lines from water heaters that do not come with factory installed heat traps or are not connected to a recirculation system.

END OF SECTION

SECTION 22 13 16 - LIQUID WASTE TRANSFER

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description:

1. This section describes specific requirements, products, and methods of execution relating to the transfer of liquid waste for the project. The work of this section includes providing the following:

a. All liquid waste piping and fittings:

1) Soil

2) Rain leaders

3) Building sewer

b. All plumbing vents, including their termination.

c. All connections at points of collection of handling:

1) At plumbing fixtures and trims

2) At equipment by others

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

C. All materials exposed within a plenum shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke developed index of not more than 50 when tested in accordance with ASTM E 84.

IF PVC OR CPVC IS USED IN PLENUM SPACES IN LIEU OF CAST IRON, THEN PIPING MUST BE WRAPPED WITH CODE APPROVED INSULATION TO PROTECT PIPING AND MEET 25/50 REQUIREMENTS.

D. All waste, vent, sewer and storm lines shall be of cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPI) and be listed by NSF International as well as conform to the requirements of CISPI Standard 301, ASTM A-888 or ASTM A-74 for all pipe and fittings, and be manufactured by Charlotte, Tyler, or AB&I .

E. All pipe and fittings shall be manufactured in the United States.

F. A complete waste and vent system will be provided to collect sanitary waste from all plumbing fixtures, floor drains, and any other equipment, in accordance with the Plumbing Code, unless indicated otherwise.

G. The drainage piping system will be designed with a minimum slope of 1/4-inch per foot for pipe sizes less than 3-inch and 1/8-inch per foot for sizes 3-inch and larger.

H. The building will have sanitary sewer lines discharging to the site sanitary sewer system.

I. Floor and wall cleanouts will be strategically placed to avoid being located in sensitive areas.

J. Floor drains will be provided for each air handling device, equipment requiring drains, toilet rooms with water closets, and mechanical equipment rooms. A floor drain will be provided at each emergency shower unit.

K. Each floor drain will be provided with a p-trap and a trap primer.

1.02 CONNECTION TO UTILITY SEWER AND STORM DRAIN SYSTEMS (storm drain piping is considered to be piping beyond 5'-0" outside the building)

A. Final wastewater connection point to extend approximately five feet (5') outside the building, as indicated on the drawings. Coordinate with Civil Drawings for wastewater service point to within five feet (5') of the building. **Coordinate with site utilities to insure proper inverts for all lines and connection point prior to installation**. Contact Architect immediately if any conflict is discovered. Make final connection to service line. Obtain all permits, pay fees and provide all services incidental to this work.

PART 2 – PRODUCTS

2.01 SEWER PIPE UNDERGROUND INSIDE STRUCTURE (INCLUDES TO FIVE FEET FROM BUILDING PERIMETER)

A. Service weight cast iron soil pipe with Tyseal neoprene gaskets.

B. Schedule 40 solid core PVC (DWV pipe and fittings) as allowed by code. Material Data: Type 1, Grade 1 PVC 12454-B, ASTM D-1784.

C. Pipe 1-1/2" and Smaller: Schedule 40 galvanized steel pipe with cast iron drainage fittings.

D. Waste line serving commercial dishwasher in kitchen and associated main to be service weight cast iron soil pipe with Tyseal neoprene gaskets, to a point twenty feet (20') downstream of dishwasher. Remainder of grease system in kitchen may be PVC as listed in 2 above.

2.02 RAINLEADERS BELOW SLAB AND ABOVE GROUND INSIDE STRUCTURE

A. Cast iron soil pipe with heavy weight no-hub fittings.

B. Underground RAINLEADER piping: Use stainless steel couplings (28-gauge, Type 304SS) with neoprene gasket meeting ASTM Standard C-564 meeting FM 1680, Class 1. Husky SD 4000, Clamp-All 80 lb. or equal.

2.03 SEWER ABOVE GROUND INSIDE STRUCTURE

A. Service weight cast iron soil pipe with tyseal neoprene gaskets or cast iron soil pipe with no-hub fittings. Reference 2.06 below.

2.04 VENTS

A. All vent piping above slab to be cast iron soil pipe with tyseal neoprene gaskets or no-hub fittings.

B. All vent piping under slab to be heavy weight no-hub fittings.

C. DWV copper with wrought or cast solder fittings.

2.05 CAST IRON PIPE/FITTINGS

A. Tyseal Gaskets or MG Couplings.

B. Hubless couplings shall be composed of a stainless steel shield, clamp assembly and an elastromeric sealing sleeve conforming to the most current edition of CISPI 310, listed by NSF International, manufactured in the United States of America, and manufactured by Anaco, Mission, Tyler or Ideal. Provide minimum 80LB torque standard couplings for standard fittings inside structure above slab and heavy duty couplings with double bands rated for 120LB torque for all below slab and underground piping.

2.06 CONDENSATE PIPING

A. Type L or M: Hard drawn copper.

PART 3 – EXECUTION

3.01 INSTALLATION OF UNDERGROUND PIPING

A. Install pipe and fittings to required grade with hubs and bottom half section in undisturbed soil. Follow manufacturer's installation requirements.

3.02 INSTALLATION OF ABOVE GROUND PIPING

A. Refer to Section 20 01 00.

3.03 GRADING

A. Grade all horizontal runs of pipe in building and under floor slab at 1/4" per foot downward in direction of flow. If it is absolutely impossible to maintain a grade of 1/4" per foot, piping four (4) inches in diameter and larger may slope to a minimum grade of not less than 1/8" per foot.

3.04 SUPPORTING

A. Support all horizontal runs of pipe in building at intervals not to exceed 5'-0" and at each change of direction. Provide a support at the base of vertical risers with intermediate supports as required. Brace all adequately to prevent motion, per manufacturer's recommendation. Reference Section 20 01 00, 2.08, B., Mechanical Support Devices and Pipe Supports for further requirements.

3.05 CLEANOUTS

A. Provide cleanouts as shown on plans and in an accessible location at base of all risers in soil, waste and drain piping and at each change in direction in horizontal runs of pipe. In long straight runs, provide a cleanout located at intervals of not more than 75 feet for piping four inches (4") and larger and located at intervals of not more than 50 feet for piping less than four inches (4").

B. Cleanouts shall be located no closer than 24" to a wall.

3.06 VENTING

A. Provide a vent for each trap or as shown on the drawings.

B. Extend each vent vertically to a point not less than six inches (6") above the extreme overflow level of the fixture served before offsetting horizontally. Whenever two or more vent pipes converge, extend each such pipe at least six inches (6") in height above the flood rim level of the plumbing fixture it serves before being connected to any other vent and utilize only approved drainage fittings and materials to connect piping.

C. Provide a building main relief vent for waste piping not provided venting by fixture branch connections. Vent size shall be per code requirement, based upon fixture unit loading in the pipe vented.

3.07 VENTS THROUGH ROOF

A. Extend vents through the roof a minimum distance of 6" and terminate at least 15 ft. horizontally from operable windows, doors, or air intakes, and at least 3 feet above such opening. Do not terminate vents through roof at edge or valley of roof.

B. Flash and counterflash vents through roof. Provide flashings not less than 18" square, with prefabricated 4-pound lead counterflashing. Extend vertical portion of flashing up entire length of pipe and turn down inside the pipe at least 1 inch with turned edge hammered against pipe. Coordinate with type roof and Architectural details and flash them into roof according to the roofing products manufacturer's recommendations.

C. Protect the roof from tools and equipment. Remove all scraps on roof to prevent damage to roof.

3.08 GENERAL

A. No piping shall be permanently concealed before the examination is completed by the authorities having jurisdiction.

B. All fixtures used in conjunction with the conveying of waste substance shall be connected by means of a trap.

C. All connections for floor mounted water closets and waste piping shall be made with appropriate closet flange and wax gaskets.

D. Insulate all exposed p-traps for handicapped lavatories and handicap sinks with "Handi Lav-Guard" Insulation Kit (Phone: 203-875-2868) as required.

E. Provide specialty shielded transition coupling as required at connections between PVC and cast iron fitting.

F. Horizontal to horizontal connections cannot use double combo, double wye and one eighth or sanitary cross fittings.

3.09 TESTING

A. Test all piping in accordance with the requirements of the local codes.

B. Repair leaks and retest system, repeating this process until piping system is free of leaks.

C. Test shall be conducted and completed before any joints are concealed or made inaccessible.

D. Maintain a log of tests indicating date, time, result of test and person doing test.

E. Under floor

1. Test pipe under floors before connecting to sewers.

2. Maintain not less than 15 feet of hydrostatic head.

3. Repair all leaks and repeat until system holds for 2-hours without a drop in water level.

3.10 CONDENSATE PIPING

A. Route insulated copper condensate drain line from each unit to nearest floor drain, deep seal traps, sink p-traps, janitor sink, dry well (exterior units), or roof drain if piped to storm sewer (cannot use roof drain if day lites at surface) code approved or disposal point unless otherwise noted. Condensate shall not drain on to roof. Mechanical Contractor and Plumbing Contractor to coordinate locations. Slope all piping to drain at minimum 1/8" per foot. Drains shall be sized in accordance with equipment capacities as follows:

EQUIPMENT CAPACITY	*MINIMUM PIPE SIZE
Up to 3 tons of refrigeration	3/4"
3 to 20 tons of refrigeration	1"
21 to 90 tons of refrigeration	1-1/4"
91 to 125 tons of refrigeration	1-1/2"
126 to 250 tons of refrigeration	2"

*Minimum size of drain shall not be smaller than drain outlet size for unit.

B. Coordinate mounting heights of units to allow adequate slope for condensate piping to disposal point.

C. Provide cleanout plug at end of each main run.

D. Drywell (French Drain): The drywell shall consist of a pit not less than 24" in diameter (or 24" x 24") and 24" in depth. The pit shall be filled to within 3" of the finished grade with course gravel. Top 3 inches to be filled with topsoil and sodded. Gravel to be wrapped completely (top, sides and bottom) with heavy duty weed block fabric. Install a 3" perforated PVC drain pipe (centered in drywell) with cap at bottom extending to bottom of pit. 3" perforated pipe to extend 3" - 5" above finished grade. Provide appropriately sized bushing or fittings to rigidly tie to condensate drain line from unit. Perforated pipe above grade will act as air break connection. Twenty-four inch (24") diameter or 24" x 24" x 24" deep can be used for up to 5 ton capacity. Thirty-six inch (36") diameter or 36" x 36" x 24" deep can be used for up to 13 ton capacity. Forty-eight (48") inch diameter or 48" x 48" x 24" deep can be used for up to 30 ton capacity. Confirm final requirements with code authority having jurisdiction.

END OF SECTION

SECTION 22 30 00 - PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. This section describes certain components of domestic plumbing systems, including related specific requirements, products and methods of execution. Plumbing water, waste, vent piping and other primary distribution components of the plumbing system are included with related work specified elsewhere.

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 - PRODUCTS

2.01 FLOOR DRAINS

A. All floor drains, including floor sinks, are to be the same size as the waste line size indicated on plans. If size is not indicated, drain size shall be 3". Top of floor drains and sinks to be flush with finished floor. Floor drains that tie in to acid waste piping are to have acid resistant coating or be stainless steel. Floor Drains and Floor Sinks in kitchen areas are to have Acid Resistant Enamel coating or be constructed from stainless steel.

B. **PROVIDE TRAP PRIMING APPARATUS FOR EACH FLOOR DRAIN AND FLOOR SINK UNLESS NOTED OTHERWISE.** Whenever possible, use an inverted tee connection from sink tailpiece or device similar to Jay R Smith Prime-EZE for trap priming with gray water. Second choice is to use flush valve trap primer connection. As last resort, provide mechanical trap primer (Manufacturer: Precision Plumbing Products, “Oregon #1 or equal as required) connected to supply lines as small as possible, but never over 1-1/2” diameter. Provide minimum 12 x 12 access door or larger as required. When local jurisdiction (such as the City of Pflugerville, Tx.) does not approve the use of a standard mechanical trap primer (similar to Oregon #1) that activates from pressure differential and other methods are not practical, provide an electronic trap primer as last resort. Coordinate electrical requirements with electrical contractor. Proset “TRAP GUARD” device may be used in lieu of trap primers when allowed by local code authority having jurisdiction and building Owner. Before using Proset “TRAP GUARD” contractor must obtain written approval from Owner and local code authority having jurisdiction and provide copies to Architect and Engineer.

C. Trap primers must conform to ASSE 1018 or ASSE 1044.

D. Trap Primer Manufacturers: MIFAB, Precision Plumbing Products, Jay R Smith, Sloan, Zurn, Wade or Watts.

E. Floor Drain/Floor Sink Manufacturers: StainlessDrains, Kessel, MIFAB, Josam, Wade, Zurn or Jay.R. Smith, Watts.

2.02 ROOF DRAINS

A. Provide 30" square, four pound lead flashing for all roof drains, centered around drain. Coordinate with type roof and Architectural Roof Plan and Architectural details. Roof drains to be installed in low point of roof. Verify low point in roof before installation. Roof drains to be moved at no additional cost to owner if not coordinated and installed in low point of roof to allow for proper drainage.

B. Where horizontal offset is not possible directly below drain connection, install an expansion joint directly under the drain. MIFAB R1900 Series.

C. All roof drains shall be same size as the rainleader piping size serving roof drain as indicated on the drawings.

D. Roof Drains:

RD1 Primary roof drain, cast iron body, flashing collar, gravel stop, ductile iron dome, under deck clamp, extension and sump receiver. MIFAB R1200-M-E-U Series.

RD2 Overflow roof drain same as RD-1, set inlet 2 inches higher than inlet of RD-1. MIFAB R1200-M-E-U-W. Coordinate and confirm final location with roofing consultant prior to rough-in.

E. Manufacturers: StainlessDrains ,MIFAB, J.R. Smith, Zurn, Josam, Wade, Watts or approved equal.

2.03 CLEANOUTS

A. Cleanouts shall be same nominal size of pipe lines up to four inches (4") and not less than four inches (4") for larger lines.

B. Floor Cleanouts: Gas and watertight seal, internal taper ABS cleanout plug, stainless steel or nickel bronze finish, scoriated round top with countersunk screw for installation flush with finish floor. MIFAB C1100R-3 Series. If floor has a waterproof membrane, then add C clamp ring flange.

C. Wall Cleanouts: MIFAB C1400-RD Series. Countersunk plugs, with smooth round access cover and polished stainless steel or nickel bronze finish.

D. Manufacturers: StainlessDrains, MIFAB, Josam, Zurn, Wade, Watts or approved equal.

E. Cleanouts that tie in to acid waste piping to be acid resistant.

2.04 FIXTURES

A. Manufacturers:

1. The fixtures are chosen from standard manufacturers.

2. Provide all similar fixtures and trim from one (1) manufacturer, except where specified otherwise.

3. Equality: The following manufacturers are considered equal, specified item(s) sets minimum standard for acceptability.

a. **Fixtures:** American Standard, Eljer, Kohler, Elkay, Fiat, Sloan, Toto, Zurn, Caroma.

1) All water closet bowls shall have fully glazed trap.

2) All water closet bowls must meet MAP Testing (Maxim Performance Testing) at 1000 grams.

b. **Faucets:** American Standard, Bradley, Elkay, Chicago, Sloan, Zurn, T & S Brass, Moen Commercial. **Must have five (5) year Commercial Warranty**. **PROVIDE CONFIRMATION OF WARRANTY IN SUBMITTAL.**

c. **Stainless Steel Sinks:** Elkay, Bradley, Moen or Just.

d. **Carriers:** MIFAB, J.R. Smith, Josam, Watts or Zurn.

e. **Flush Valves:** Sloan Royal or equal by Zurn

f. **Point of Use ASSE 1070 Lead Free Mixing Valves:** Watts, Powers, Bradley, Leonard, Lawler, Symmons or Moen.

g. **Drinking Fountains/Electric Water Coolers:** Elkay, Acorn Aqua Surf, Oasis or Halsey Taylor, must meet NSF Section 9 in its entirety and meet TCEQ Certification Requirements. Provide letter with submittal data.

h. **Wash Fountains**: Bradley, Wiloughby or Sloan Stone.

i. **Wall Pipe Supports**: HoldRite or Equal

j. **Acrylic Showers**: Lasco, Aquabath

k. **Circulating Pumps**: TACO, Grundfos, Armstrong, Wilo

l. Stainless Steel Skullery Sinks: Elkay, Bradley, Just, Advance Tabco, Griffin.

m. Provide wall carriers for ALL wall-mounted fixtures, including wash fountains.

B. Traps, Stops and Supplies:

1. Provide traps, stops and supplies for all fixtures.

2. P-Traps: 17 gauge chrome-plated cast brass. Provide offset type as required to meet ADA space requirements.

3. Supplies: Flexible, chrome-plated, 7538 Series.

4. Stops: Quarter (1/4) turn removable key type, 2302 Series.

5. Supplies and stops are to meet current requirements of NSF61.

6. Manufacturers: American Standard, Brass Craft, McGuire or equal.

C. Fixtures Specified Elsewhere, or Otherwise Furnished. Provide appropriate strainer, tailpiece, trap, waste and supplies. Rough-in and connect only.

D. Faucets:

1. All faucets except commercial kitchen and bar sinks are to meet ANSI/NSF Standard 61 and be listed by NSF as residential drinking water faucets.

2. All faucets not NSF 61 listed, (as described in paragraph 1) must have tin lined waterways or other such material so water flowing through the faucet is not in contact with any material that could allow “Leaching” of lead into the waterway.

3. Commercial kitchen and bar sinks are to meet ANSI/NSF Standard 61 and be listed as commercial faucets. Faucets meeting the stricter residential standards can be used at contractor’s option.

4. Faucets are not allowed to have more than the maximum total lead content as listed by NSF, TCEQ (Health and Safety Code) and EPA.

5. Any faucets which exceed lead concentration "Leaching" into water stream after a minimum of 45 days usage and proper flushing prior to testing shall be replaced by the manufacturer with an acceptable product. All costs of change out incurred will be sole responsibility of the manufacturer.

6. Lavatory faucets to have .5 GPM vandal resistant aerator.

E. Waterways and tanks for all drinking fountains and water coolers shall be constructed of 3. lead-free (0.00% lead) materials. All waterways to be totally free of lead. No lead solder is permitted. All drinking fountains and water coolers to meet latest criteria of TCEQ, EPA and be listed by NSF.

F. All water line, fittings and fixtures in contact with potable water to be "lead free" AB1953 compliant. (.25% or less average lead content). All submittals to state items comply in submittal package.

2.05 FIXTURE FLOW RATES

A. The maximum flow rates for plumbing fixtures are to be no greater than quantities listed below:

1. Toilets – 1.28 gallons per flush GPF) on all projects .

2. Urinals – 0.125 gallons per flush (GPF) on all projects

3. Lavatory (hand sink) – 0.5 gallons per minute (GPM) on all projects

4. Shower – 2.0 gallons per minute (GPM) on all projects

PART 3 - EXECUTION

3.01 Store all fixtures and trim above ground in a covered location not subject to accidental damage by traffic or other construction activities. Handle fixtures and trim carefully to avoid chipping, denting, scratching, or other damage. Replace damaged items with same item in new condition.

3.02 Provide permanent metal and wire positioners, supports and fixture carriers to secure fixtures and piping rigidly in proper alignment without sway or side play.

3.03 Anchor all fixtures securely to withstand applied vertical load of not less than 250 pounds on the front of the fixture, without noticeable movement.

3.04 Install all fixtures plumb, level and flush to the finished Architectural surface, so that the maximum gap between the fixture and the surface does not exceed 3/16 inch. **Grout** under water closets to level fixtures. Caulk the edge of the joint between fixture and surface with silicone or butyl type waterproof caulking compound.

3.05 Adjust all functional components for proper operation in accordance with manufacturer's recommendations, or as otherwise directed.

3.06 Clean all fixtures and trim thoroughly to spotlessly clean condition. Obtain a written certification from the Architect that this has been accomplished.

3.07 Where floor drains or janitor sinks are located over any room, provide waterproof installation.

3.08 Ensure final location of cleanouts have access and ample clearance at cleanout for rodding of drainage system. Check locations before installation. Contact Architect for alternate location if maintenance clearance is a problem. Cleanouts to be moved at no additional cost to Owner for failure to coordinate locations.

3.09 Coordinate slope of floors to floor drains with Architect. Adjust height of floor drain for proper drainage.

3.10 Provide all adapters, flanges, gaskets, etc. as required for proper installation of fixtures. Coordinate fixture placement before core drilling of floor or sleeve installation.

3.11 Insulate all exposed p-traps and water connections for handicapped lavatories with White "Truebro Handi Lav-Guard" Insulation Kit Model #102W (Use Model #105W when 5" offset strainer is used). (Phone: 203-875-2868), or equal products as manufactured by Brocar Products Inc., (Phone: 512-847-1524).

3.12 **No offset flanges will be allowed for installation of water closets.**

3.13 Install all trap priming devices per manufacturer's installation instructions. Provide shut-off valves at each mechanical or electronic trap primer for service. Install minimum 12" x 12" access doors as required for service of trap priming devices.

3.14 Provide a floor sink with trap priming device in each sprinkler riser room.

3.15 Cleanout locations:

A. On each horizontal drain line 5 feet or greater in length.

B. No more than 50 feet on center.

C. At changes in director of 90 degrees or more (line size).

D. At the end of each continuous waste line.

E. At the end of each battery of fixtures.

F. At each sink and urinal.

G. Additional areas required for service and by code.

END OF SECTION

SECTION 23 05 93 – TEST AND BALANCE

PART 1 - GENERAL

1.01 DESCRIPTION

A. The section describes general requirements and methods of execution relating to the testing and balancing of the mechanical systems provided on this project. Plans and specifications are complimentary. Carefully look at both.

B. Scope:

1. Furnish the services of a qualified and approved Testing and Balancing Agency to perform the work of this specification.

2. The work of this section includes, but is not necessarily limited to:

a. Testing and balancing all fans, all air handling systems, all energy recovery ventilators and makeup air systems.

b. Providing a final report. Final report to be submitted for review only after all deficiencies have been corrected and design CFM's are achieved.

c. Reference Cx Commissioning specification for additional information and requirements.

C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 APPLICABLE STANDARDS

A. SMACNA Manual for the Balancing and Adjustment of Air Distribution Systems.

B. AMCA Publication 203, Field Performance Measurements.

C. AMCA Standard 300-67, Test Code for Sound Rating.

D. National Environmental Balancing Bureau (NEBB) Recommended Procedures.

E. National Balancing Council (NBC)

1.03 PRE-QUALIFIED AGENCY

A. Subcontractor Minimum Qualifications Include:

1. Maintain a complete service organization that has operated within a one hundred (100) mile radius of the project for at least three years prior to bid date of this project.

2. Demonstrate satisfactory completion of three projects of similar size and scope. Provide references if requested.

3. Bids by suppliers, Contractors or any firm not listed in #5 below are not acceptable.

4. Independent, NEBB or TABB certified agency with no affiliation to mechanical contractor.

5. Pre-qualified T & B Agencies are as follows:

   a. Air Technologies (512)280-3398.

   b. PHI (512)339-4757.

   c. CenTex Air Balance Inc (254)913-3132.

1.04 TIMING OF WORK

A. Do not begin testing and balancing until the systems are completed and in full working order.

B. Schedule the testing and balancing work in cooperation with other trades.

C. Complete the testing and balancing before the date of final project completion.

1.05 MECHANICAL CONTRACTOR RESPONSIBILITY TO BALANCING AGENCY

A. Award the test and balance contract to the approved agency upon receipt of contract to allow the Balance and Testing Agency to schedule this work in cooperation with other trades involved and comply with completion date.

B. Put all heating, ventilating, and air conditioning systems, equipment and controls into full operation for the Balancing Agency and continue the operation of same during each working day of testing and balancing.

C. Provide scaffolding, ladders and access to each system for proper testing and balancing.

D. Provide and change pulleys, belts and dampers, add any dampers and correct any installation errors in a timely matter as required for correct balance as recommended by the Balance and Testing Agency or as directed by the Architect after review of Balancing Report, at no additional cost to the Owner.

PART 2 - PRODUCTS

THIS PART NOT USED.

PART 3 - EXECUTION

3.01 INSTRUMENTS

A. Maintain all instruments accurately calibrated and in good working order. Use instruments with the following minimum performance characteristics.

B. Air Velocity Instruments: Direct reading in feet per minute, 2% accuracy.

C. Static Pressure Instruments: Direct reading in inches water gauge, 2% accuracy.

D. RPM Instruments: Direct reading in revolutions per minute, 1/2% accuracy; or revolution counter accurate within 2 counts per 1000.

E. Temperature Readout: Direct reading in degrees F., plus minus 0.1 degrees F.

3.02 GENERAL PROCEDURES FOR ALL SYSTEMS

A. In cooperation with the Contractor's representative, coordinate adjustments of automatically operated dampers and valves, including the controlling thermostats, to operate as specified, indicated, and/or noted.

B. Use manufacturer's ratings on all equipment to make required calculations.

C. MAKE FINAL ADJUSTMENTS FOR EACH SPACE PER HEATING OR COOLING COMFORT REQUIREMENT. State reason for variance from design cfm, i.e., “too noisy”, “too drafty”, etc.

D. Balancing to occur with clean filters when applicable and wet coils when applicable.

3.03 REQUIREMENTS FOR ALL AIR HANDLING SYSTEMS

A. Identify each diffuser, grille, and register as to specific location and area.

B. Identify and list size, type and manufacturer of diffusers, grilles, registers and all equipment tested.

C. In readings and tests of diffusers, grilles and registers, include required fpm velocity and required cfm and test cfm after adjustments. If test apparatus is designed to read cfm directly, velocity readings may be omitted. Identify test apparatus used. Identify wide open (W.O.) runs.

D. Adjust all diffusers, grilles and registers to minimize drafts and excess noise in all areas.

3.04 BALANCING LOW VELOCITY DUCTWORK

A. After adjusting blower to lowest overall point possible, adjust the branch dampers so that each stale air exhaust inlet or outside air supply outlet in the system is to + or - 5% of design airflow on all makeup air units and energy recovery ventilators.

B. All other HVAC systems on the project are to be adjusted as per ‘A’ above except to + or - 10% of design airflow. **However, DX comfort cooling units are to be balanced to never exceed 410 cfm/ton or be less than 300 cfm/ton on highest stage. Notify engineer if plans deviate from this CFM range for guidance. 5 ton units must be balanced to provide under 2000 CFM. Use CFM shown at air devices, *not* nominal CFM shown on equipment schedule. See Note ‘D’ on RTU Master Schedule. On low stage cooling, set units to provide approximately 66% of high stage cooling CFM.**

C. **Adjust the fan for design airflow on constant volume systems. Adjust fan for highest stage airflow on all systems with varying airflow, with fan and compressor on highest stage. On multistage units requiring it, set up fan to match all lower stages of cooling as required. If unit is set up incorrectly with T&B done for high stage with unit only asking for lower stage compressor stage, unit will not dehumidify and balance will have to be redone at no additional cost. Verify proper procedures with equipment manufacturer and engineer**.

D. Read and record the airflow at each return or exhaust inlet and each supply outlet. Balance as required on constant volume and/or highest stage.

E. Secure each branch damper and mark the balanced position of the damper quadrant.

F. Adjust fan for each stage of airflow (to match compressor staging) on all systems with varying airflow.

G. Read and record the airflow at each supply outlet in all lower stages. On infinite variable flow blowers on units with variable speed compressors measure and record airflow at lowest stage of compressor loading.

H. 2 to 6 ton units are generally 2 stage with compressor capacity of either 66% of rated tonnage on low stage or 100% of capacity on high stage. For these units air device CFM is used for high stage operation and low stage CFM is to be set for approximately 66% of listed air device CFM. Some manufacturers have built in logic to drop fan speed to match cooling stage and some require it to be set manually.

I. For larger units with multiple compressors, set blower CFM to match capacity of operational stage(s) of cooling. Confirm capacities and required CFM setting procedures for blower with equipment supplier. Default is 66% of high stage cooling when there are two stages of cooling.

J. For chilled water AHU's set airflow on high to match air device CFM shown. Read sequence of operation. If blower CFM is integrated to chilled/hot water valve opening position, also record lowest blower CFM setting allowed (usually about 35% of air device CFM shown).

3.05 FAN ADJUSTMENT

A. Balance ductwork before making final fan adjustment for highest stage or constant volume.

B. Verify that system is free of debris and that inlets and discharges are not obstructed and that filters are clean.

C. Make pitot traverse of main ductwork to determine total airflow and record.

D. Adjust fan rpm to obtain design airflow.

E. Test and record motor amperage and voltage on each phase leg. Reduce fan rpm if necessary, so that motor running amperage does not exceed motor nameplate amperage. Record final amperage and voltage.

F. Record fan rpm.

G. Test and record system (suction) return and (discharge) supply static pressures on highest CFM.

H. Record airflow.

I. Test and adjust system for minimum design cfm outside air (intake and exhaust), as shown, where applicable.

J. **Test and record entering air temperatures across coils and fans on highest and on lowest stages of cooling/heating**.

K. Test and record leaving air temperatures (heating and cooling) across coils.

L. Test and record entering air temperature and humidity plus leaving air temperatures and humidity delivered to space on all makeup air/outside air units in cooling mode.

M. Test and record static pressure drop across each filter and coil bank on highest stage.

N. Provide test data for each AHU, FCU, RTU, MAU, ERV, EF, SF, ETC., used on project:

Test and document operation of each MAU, RTU, AHU, CU, HP and FAN in all modes of operation and in all stages of operation. Insure that all pieces of HVAC equipment are functioning properly and are properly connected to the control system. **Check and document inlet and outlet temperatures in all stages of cooling, heating, reheat and emergency heating modes, if unit is so equipped.**

3.06 BALANCING REPORT

A. Compile the test data and submit 8 copies of the complete test data for forwarding to the Architect for acceptance and/or analysis and recommendations. Report must be complete and all deficiencies corrected prior to submittal to architect.

B. Include a complete list of all test equipment used, including apparatus manufacturer's name, model number, serial number and date last calibrated.

C. Include complete identification of all elements. Identify by unit number, room name and number, air outlet symbol, etc., to clearly and positively identify the location of each element.

D. Include all test data specified in addition to test data recommended in the applicable standards referenced in Part 1. Tabulate all nameplate data at all balanced equipment and at the associated motors.

E. Tabulate data separately for each system. Describe balancing method used for each system.

F. Include at the front of the report a summary of problems encountered, deviations from design, resolution of problems, recommendations and comments.

END OF SECTION

SECTION 23 08 02 - CONTRACTOR START-UP

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description:

1. **This section describes specific requirements and methods of execution which relate to the Contractor start-up of the mechanical installation by the mechanical contractor and their subcontractor's, acting together as a team**. **The contractor, all their subs and vendors (as required) will spend sufficient time TOGETHER at the site to insure that all requirements are met.**

2. Contractor start-up is a performance verification and documentation process of ensuring that all mechanical systems are installed and are performing according to the design intent and operational needs of the project. The Contractor start-up process encompasses a coordinated effort for system documentation, equipment startup, control system calibration, testing and balancing, and performance testing and training.

3. Contractor start-up by the contractor during the construction phase is intended to achieve the following specific objectives;

   a. Verify that applicable equipment, controls and systems are installed according to the plans and specifications, manufacturer's recommendations and to industry accepted minimum standards.

   b. **Verify and document proper performance of equipment and systems as a whole and as controlled by the DDC system. Verify that total integration of the mechanical and DDC systems are complete and fully operational in all modes. This requires both the mechanical contractor and the control contractor to work together at the site at the same time as required. Testing equipment operation with jumper wires or in a stand-alone mode and/or testing controls for continuity does not meet the requirements of this section**.

   c. Verify that the Owner's operating personnel are adequately trained.

   d. Verify balancing report is completed and outside ventilation air quantities are confirmed.

4. RETAINAGE WILL NOT BE RELEASED UNTIL WORK OF THIS SECTION IS SUCCESSFULLY COMPLETED. IF THE CONTRACTOR CAN'T COMPLETE THIS WORK IN A TIMELY FASHION IT WILL BE ASSIGNED TO A THIRD PARTY FOR COMPLETION AND BILLED AGAINST THE CONTRACTORS' RETAINAGE.

B. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

PART 2 - PRODUCTS

2.01 TEST EQUIPMENT

A. All standard testing equipment required to perform startup and checkout and functional performance testing shall be provided by the contractor for the equipment being tested.

B. Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according the Contract Documents shall be included in the base bid price to the Contractor.

C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5^0 F and a resolution of + or - 0.1^0 F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals. Calibration tags shall be affixed or certificates readily available.

PART 3 - EXECUTION

3.01 MEETINGS

A. Pre-Contractor start-up Meeting: At the beginning of the project the contractor shall schedule, plan and conduct a pre-Contractor start-up meeting with the Owner, engineer and construction manager to discuss process and procedures to be used in contractor Contractor start-up process.

B. Miscellaneous Meetings: Other meetings will be held throughout project at owner, engineer or contractor request during construction, to cover Contractor start-up progress coordination, deficiencies, and other Contractor start-up issues.

3.02 EQUIPMENT REQUIRING MANUFACTURER START-UP:

A. Standard manufacturer start-up forms shall be submitted for review.

B. HCE forms must be fully completed and included in the Contractor start-up report.

C. All standard forms shall be signed and dated by technician doing start-up and shall be included in final Contractor start-up report.

3.03 TESTING CRITERIA:

A. Systems shall be tested in all modes of operation (ie. cooling/heating, dehumidification, occupied/unoccupied modes, etc.). Systems may be started up in a stand-alone mode before control integration is complete, however all HVAC systems must be totally rechecked in all modes of operation through the manipulation of the DDC system once that part of the work is complete. Using jumper wires and testing for continuity does not meet the testing requirements.

B. Tests are to be performed under conditions that simulate actual conditions where possible. Simulated test conditions are allowed in order to confirm system functions at required conditions. At completion of individual tests, all affected building equipment and setpoints shall be returned to their pre-test condition.

C. Simply filling out the associated Contractor start-up Form does not totally satisfy all requirements of this section. Perform all testing as outlined in this section. Provide signed and dated documentation of all testing. Legible field notes that are signed and dated are acceptable.

3.04 CONTROLS:

A. A sequence shall be submitted that gives a clear concise narrative of the functional operation for each different system. This should be coordinated with control submittal.

B. Confirm as a minimum, the following for each space sensor (temperature, humidity, CO_2):

1. Verify that sensor is labeled to match associated equipment number.

2. Verify that foam isolation pad is installed behind sensor.

3. Verify sensor location is appropriate and not in direct airflow from adjacent grille or sunlight.

4. Verify that sensor element is not in contact with cover, base or set point adjustment.

5. Test sensor with separate meter adjacent to (with-in 4 inches) sensor and verify building automation system (BAS) readout is with-in tolerance. Adjust offset as required for proper calibration. Recheck sensor. Insure measuring instrument is allowed to settle out at each sensor prior to confirming reading. Temperature tolerance is +/-0 .5^{0}F, humidistat tolerance is +/- 3%.

6. Replace any bad sensors, and document which sensor is replaced.

7. Confirm that push button override is set for 120 minutes.

8. Confirm that push button override is operational.

9. Confirm that set point adjustment at thermostat is set for +/- 3^{0}F.

10. Confirm occupied heating, cooling and RH set points.

11. Confirm occupancy schedules. (May turn over to Owner with floor level schedule set at 7am to 4pm with no imbedded schedules at equipment level at owner's request.)

12. Confirm fan status (continuous or automatic mode).

13. Confirm that zone sensors are properly located, labeled and that they actually control the equipment that serves that zone.

14. Physically confirm that the HVAC equipment performs all of the functions that the controls can command it to do, in all modes. Continuity check alone is NOT SUFFICIENT.

15. CONFIRM THAT ANY INTEGRAL UNIT MOUNTED CONTROL SETTINGS HAVE BEEN PROPERLY SET UP TO MATCH THE JOB REQUIREMENTS AND TO PROPERLY INTEGRATE WITH THE DDC SYSTEM AS INSTALLED.

C. Document all test data for sensors, etc, on appropriate control system Contractor start-up Forms.

3.05 SPLIT SYSTEMS:

A. Submit any required manufacturer's start-up test report.

B. In addition to any start-up reports perform checkout and record the following for each piece of equipment.

1. Unit size and model number.

2. Outside air (O/A) temperature and humidity during testing period.

3. Verify interior of unit is clean.

4. Insure O/A damper has been adjusted and balanced, permanently mark position of damper.

5. Verify that fan rotation is correct.

6. Verify that cooling coil is clean.

7. Verify that condenser coil is clean and fins are not damaged.

8. Verify that hail guards are installed if specified.

9. Confirm that condensate drain and trap are installed properly and drain pan is clean.

10. Verify that overflow switch is installed and working properly for AHU's.

11. Verify that heating and cooling modes are functioning and record inlet and discharge air temperatures in each mode.

12. Verify that hot gas reheat is working properly in dehumidification mode. Record inlet and discharge temperature.

13. Verify that filters are clean.

14. Confirm that belt tension and alignment has been adjusted properly.

C. Document all Contractor start-up data on Form C3.0 for Split System Units.

3.06 MAKE-UP AIR EQUIPMENT:

A. Submit manufacturer start-up tests reports.

B. In addition to start-up reports, test and record the following points:

1. Outside air temperature and humidity during testing mode.

2. Supply air: temperature/humidity.

3. Return air: temperature/humidity.

4. Temperature/humidity entering and leaving each coil, heater and/or energy recovery device in machine.

5. Verify fan(s) rotation.

6. Verify that each energy recovery wheel is rotating.

7. Verify operation in both heating and cooling mode. Submit print-out of all system points at design conditions. May occur during warranty period depending upon season completed.

8. Confirm that condensate drain and trap are installed properly and drain pan is clean.

9. Verify occupied/unoccupied time schedules.

10. Verify bypass/dehumidification mode operation off building absolute humidity sensor in unoccupied mode including damper positions and supply air temperature. Verify that any exhaust damper and outside air intake damper is closed and any exhaust fans are off in this mode. Verify that return air damper to space and any bypass damper in MAU is open in this mode. Record inlet and discharge temperature and humidity.

11. Verify that any exhaust air damper and outside air intake damper closes when unit is off during unoccupied mode.

12. Confirm that belt tension and alignment has been adjusted properly.

13. Verify that all return air and outside air filters are clean.

14. Verify and/or set heating/cooling changeover at 50 degrees.

15. On 100% outside air units (without energy recovery) verify and/or set hot gas reheat to start resetting from full reheat at up to 70 degrees outdoors to no reheat at 80 degrees outside.

16. Verify that cooling coil is clean and fins are not damaged.

17. Verify that condenser coil is clean and fins are not damaged.

18. Verify that hail guards are installed.

19. Verify that interior of unit is clean.

C. Document all Contractor start-up data for 100% Outdoor Air Make-Up Air Units on Form C4.0.

CONTROL SYSTEM CONTRACTOR START-UP FOR RTU'S & SPLIT SYSTEMS
FORM C1.0

(CONTROLS CONTRACTOR)

PROJECT NAME:_____ PAGE: _____OF_____

FULL NAME OF INDIVIDUAL PERFORMING TEST:_____ DATE:_____

#	DESCRIPTION	UNIT MARK		
1	TEMP. SENSOR LABELED			
2	HUMIDITY SENSOR LABELED			
3	CO2 SENSOR LABELED			
4	FOAM ISOLATION PAD INSTALLED BEHIND SENSOR			
5	VERIFY TEMPERATURE / HUMIDITY / CO2 SENSOR LOCATION (LIST ROOM #)			
6	LIST OFFSETS INPUT TO CALIBRATE TEMPERATURE / HUMIDITY / CO2			
7	SENSOR PUSH BUTTON OVERRIDE SET FOR 120 MINUTES & FUNCTIONAL			
8	SET POINT ADJUSTMENT AT SENSOR +/- 3 DEGREES			
9	OCCUPIED COOLING SET POINT			
10	OCCUPIED HEATING SET POINT			
11	UNOCCUPIED COOLING SET POINT			
12	UNOCCUPIED HEATING SET POINT			
13	OCCUPANCY SCHEDULE			
14	HUMIDITY SET POINT (%RH)			
15	FAN STATUS ON SS/RTU A = AUTO C = CONTINUOUS			

CONTROL SYSTEM CONTRACTOR START-UP FOR RTU'S & SPLIT SYSTEMS
FORM C1.0

(CONTROLS CONTRACTOR)

PROJECT NAME:_____ PAGE: _____OF_____

FULL NAME OF INDIVIDUAL PERFORMING TEST:_____ DATE:_____

#	DESCRIPTION	UNIT MARK		
16	PHYSICALLY CHECK & VERIFY THAT CONTROL SIGNAL(S) ACTUALLY INITIATES ALL MODES OF UNIT FUNCTION REQUIRED FOR THE TYPE HVAC EQUIPMENT BEING CONTROLLED.			
17	VERIFY THAT UNITS INTERNAL CONTROL SET POINTS (ECTO SETTINGS ON LENNOX RTU'S FOR EXAMPLE) HAVE BEEN SET TO MATCH THE REQUIREMENT FOR THE EXTERNAL CONTROLS ACTUALLY INSTALLED.			
18	LIST EQUIPMENT TYPE, IE, E/E SS, HP SS, GAS HEAT RTU, E.E RTU ETC…			
19	LIST COOLING STAGES			
20	LIST HEATING STAGES			
21	IF HEAT PUMP, DOES EM. HEAT COME ON DURING DEFROST CYCLE?			
22	IF HORIZONTAL SPLIT SYSTEM, IS FLOAT SWITCH WIRED INTO CONTROLS?			
23	VERIFY THAT OWNER HAS RECEIVED SPECIFIED AMOUNT OF OWNER TRAINING.			
24	VERIFY THAT SITE COMPUTER HAS BEEN INSTALLED WITH ALL REQUIRED PROGRAMMING, GRAPHICS & BACKUP CD OF SITE SPECIFIC PROGRAMMING.			
	ok = ITEM VERIFIED AND ACCEPTABLE			
	X = ITEM NEEDS ADDITIONAL WORK AND/OR VERIFICATION			
	n/a = DOES NOT APPLY			

REMARKS:

POINT TO POINT CHECK OUT OF CONTROLS DOES NOT CONSTITUTE THE FUNCTIONAL CHECK OUT REQUIRED.

MAU CONTRACTOR START-UP
FORM C1.2

(MECHANICAL CONTRACTOR) **Page 1 of 2**

PROJECT NAME:_____ PAGE: _____OF_____

FULL NAME OF INDIVIDUAL PERFORMING TEST:_____ DATE:_____

#	DESCRIPTION	UNIT MARK		
1	**100% MAU WITHOUT ENERGY RECOVERY**			
2	TEMPERATURE & HUMIDITY AT O/A INLET			
3	TEMPERATURE AT O/A COOLING OUTLET			
4	TEMPERATURE & HUMIDITY AT UNIT SUPPLY AIR DISCHARGE			
5	**ENERGY RECOVERY UNIT**			
6	TEMPERATURE & HUMIDITY AT O/A INLET			
7	TEMPERATURE AT COOLING COIL OUTLET			
8	TEMPERATURE & HUMIDITY AT SUPPLY AIR DISCHARGE			
9	TEMPERATURE & HUMIDITY AT R/A INLET			
10	TEMPERATURE & HUMIDITY AT WHEEL INLET			
11	TEMPERATURE & HUMIDITY AT WHEEL OUTLET			
12	**ALL UNITS TO HAVE:**			
13	FAN(S) STATUS VFD SETTING AT ACTUAL CFM ACHIEVED			
14	FAN ALIGNMENT			
15	FAN ROTATION			
16	ALL BEARINGS LUBRICATED			
17	COMPRESSOR 1 AMPS/REFRIGERANT PRESSURES			
18	COMPRESSOR 2 AMPS/REFRIGERANT PRESSURES			
19	COMPRESSOR 3 AMPS/REFRIGERANT PRESSURES			
20	COMPRESSOR 4 AMPS/REFRIGERANT PRESSURES			

MAU CONTRACTOR START-UP
FORM C1.2

(MECHANICAL CONTRACTOR) **Page 2 of 2**

PROJECT NAME:_____ PAGE: _____OF_____

FULL NAME OF INDIVIDUAL PERFORMING TEST:_____ DATE:_____

#	DESCRIPTION	UNIT MARK		
21	**HEAT STATUS**			
22	STAGE 1 STATUS			
23	STAGE 2 STATUS			
24	STAGE 3 STATUS			
25	STAGE 4 STATUS			
26	HOT GAS REHEAT COIL STATUS & SETPOINT			
27	SETPOINT WHERE HOT GAS REHEAT STARTS TURNING OFF			
28	SETPOINT WHERE HOT GAS REHEAT IS COMPLETELY OFF			
29	COOLING COIL SETPOINT			
30	HEATING SETPOINT			
31	COOLING LOCKOUT SETPOINT			
32	HEATING LOCKOUT SETPOINT			
33	WHEEL STATUS & APPEARANCE			
34	HAIL GUARDS INSTALLED			
35	ARE CONDENSATE DRAINS CONNECTED, TRAPPED AND PIPED OFF			
36	**VERIFY THAT COILS ARE CLEAN & FINS STRAIGHT ON:**			
37	O/A COOLING COILS			
38	HOT GAS REHEAT COILS			
39	ALL CONDENSOR COILS			
40	REMOVE ANY OIL RESIDUE FROM MANUFACTURING & DUST FROM CONTRUCTION USE.			
41	VERIFY THAT CLEAN FILTERS ARE INSTALLED PRIOR TO T & B.			

ok = ITEM VERIFIED AND ACCEPTABLE

X = ITEM NEEDS ADDITIONAL WORK AND/OR VERIFICATION

n/a = DOES NOT APPLY

REMARKS:

SPLIT SYSTEM CONTRACTOR START-UP
FORM C3.0

(MECHANICAL CONTRACTOR)

PROJECT NAME:_____ PAGE: _____OF_____

FULL NAME OF INDIVIDUAL PERFORMING TEST:_____ DATE:_____

#	DESCRIPTION	UNIT MARK		
1	UNIT SIZE / TYPE			
2	AHU MODEL NUMBER			
3	CU/HP MODEL NUMBER			
4	INDOOR TEMPERATURE (AND RH IF AVAILABLE)			
5	OUTSIDE TEMPERATURE / HUMIDITY			
6	CONDITION OF UNIT INTERIOR C = CLEAN NC = NEEDS CLEANING			
7	OUTSIDE AIR DAMPER ADJUSTED AND MARKED			
8	OUTSIDE AIR CONNECTED PER PLANS			
9	CHECK FAN ROTATION			
10	CONDITION OF INDOOR COIL C = CLEAN NC = NEEDS CLEANING			
11	CONDITION OF COND. COIL C = CLEAN NC = NEEDS CLEANING			
12	CU / HP SECURED TO ROOF SUPPORT			
13	DRAIN PAN CLEAN			

SPLIT SYSTEM CONTRACTOR START-UP
FORM C3.O

PROJECT NAME:_____ PAGE:_____OF_____

INDIVIDUAL PERFORMING TEST:_____ DATE:_____

#	DESCRIPTION	UNIT MARK		
14	CONDENSATE DRAIN AND TRAP INSTALLED PROPERLY			
15	COOLING DISCHARGE AIR TEMP. IF MULTISTAGE, ARE ALL STAGES OF COOLING OPERATIONAL?			
16	HEATING MODE DISCHARGE AIR TEMPERATURE			
17	IF HP, DOES EM HEAT COME ON IN DEFROST CYCLE?			
18	HOT GAS REHEAT DISCHARGE AIR TEMPERATURE			
19	CONDITON OF FILTERS C =CLEAN D = DIRTY			
20	BELT TENSION AND ALIGNMENT PROPERLY ADJUSTED			
21	ATTACH START-UP FORM WITH REFRIGERANT PRESSURES, AMPS, ETC.			

ok = ITEM VERIFIED AND ACCEPTABLE

X = ITEM NEEDS ADDITIONAL WORK AND/OR VERIFICATION

n/a = DOES NOT APPLY

REMARKS:

ALL OPERATIONAL MODES ARE TO BE CHECKED BY MANIPULATING CONTROLS THAT THE OWNER WILL END UP WITH. USE OF JUMPER WIRES OR PLACING UNIT CONTROLLER IN STAND ALONE MODE IS NOT ACCEPTABLE FOR CONTRACTOR START-UP.

(100% O/A) MAKE UP AIR UNIT CONTRACTOR START-UP FORM C4.0

(MECHANICAL CONTRACTOR) **PAGE 1 OF 2**

PROJECT NAME:_____ PAGE: _____OF_____

FULL NAME OF INDIVIDUAL PERFORMING TEST:_____ DATE:_____

#	DESCRIPTION	UNIT MARK		
1	UNIT SIZE (CFM)			
2	MODEL NUMBER			
3	OUTSIDE TEMPERATURE / HUMIDITY			
4	INDOOR TEMPERATURE (AND RH IF AVAILABLE)			
5	CONDITION OF UNIT INTERIOR C = CLEAN NC = NEEDS CLEANING			
6	UNIT DAMPERS OPERATING			
7	OUTSIDE AIR HOOD INSTALLED			
8	CHECK FAN'S ROTATION			
9	CONDITION OF COOLING COIL C = CLEAN NC = NEEDS CLEANING			
10	CONDITION OF COND. COIL C = CLEAN NC = NEEDS CLEANING			
11	HAIL GUARD INSTALLED			
12	DRAIN PAN CLEAN			
13	CONDENSATE DRAIN AND TRAP INSTALLED PROPERLY			
14	DISCHARGE AIR TEMP. OFF COOLING COIL DURING COOLING MODE			
15	DISCHARGE AIR TEMP. DURING HEATING MODE			

(100% O/A) MAKE UP AIR UNIT CONTRACTOR START-UP FORM C4.0

(MECHANICAL CONTRACTOR) **PAGE 2 OF 2**

PROJECT NAME:_____ PAGE: _____OF_____

FULL NAME OF INDIVIDUAL PERFORMING TEST:_____ DATE:_____

#	DESCRIPTION	UNIT MARK		
16	HOT GAS REHEAT OPERATING PROPERLY & D.A.T.			
17	CONDITION OF FILTERS C =CLEAN D = DIRTY			
18	BELT TENSION AND ALIGNMENT PROPERLY ADJUSTED			
19	CONFIRM BYPASS MODE OPERATION FOR AFTER HOURS			
20	O/A FILTER CONDITION			
21	UNIT INTERNAL CONTROLS HEATING LOCKOUT SETPOINT			
22	UNIT INTERNAL CONTROLS COOLING LOCKOUT SETPOINT			
23	UNIT INTERNAL CONTROLS SETPOINT WHERE HOT GAS REHEAT STARTS THROTTLING			
24	UNIT INTERNAL CONTROLS SETPOINT WHERE HOT GAS REHEAT IS COMPLETELY OFF			
25	PROVIDE UNIT START-UP SHEET WITH SUCTION/HEAD PRESSURES FOR EACH CIRCUIT, COMPRESSOR AMPS, FAN AMPS, ETC.			

ok = ITEM VERIFIED AND ACCEPTABLE
X = ITEM NEEDS ADDITIONAL WORK AND/OR VERIFICATION
n/a = DOES NOT APPLY

REMARKS:

END OF SECTION

SECTION 23 11 23 - FUEL GAS SYSTEMS: (NATURAL)

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description:

This section describes specific requirements, products, and methods of execution relating to the provision of Fuel Gas Systems for the project.

B. Scope: Provide all products, including above and below ground piping, all connection to gas burning apparatus, and all work at the gas source to provide a complete system.

C. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 APPLICABLE CODES

A. Provide all products and installation in strict accordance with the following:

1. Codes listed in Section 20 00 00.

2. NFPA 54 National Fuel Gas Code

1.03 CONNECTION TO UTILITY COMPANY GAS METER

A. The local gas utility company will provide underground piping to the new meter location and the new meter. Coordinate with the utility company to establish the precise meter location, and to properly integrate their work with the other work of the project. Provide the connection at the gas meter/regulator outlet using appropriate materials, compatible joints, supports, and all other products for proper interface. Verify that the utility company has inspected, tested, and approved their work before connecting to the outlet of the meter/regulator assembly. Provide necessary protection against damage for meter.

PART 2 - PRODUCTS

2.01 PIPING

A. Schedule 40 black steel piping and fittings and conforms to standard Specifications for Welded and Seamless Steel Pipe, ASTM Designation A53, Type E or S.

B. Schedule 40 black steel pipe with black malleable iron fittings, threaded or welded black steel pipe and fittings, Viega Mega Press or equal by Apollo.

C. Wrap below ground piping with JM Trantex pipeline tape E-20, protective pipe coating and in accordance with local gas utility company regulations.

D. Piping (outside underground, medium and low pressure): Polyethylene type approved for gas service at pressure encountered (ASTM D2513). Butt heat fusion joints. Install per manufacturer's recommendations. All risers up to building to be black steel as specified from elbow up below grade, including elbow.

E. **Absolutely no galvanized piping or fittings allowed on gas system piping**.

2.02 MISCELLANEOUS PRODUCTS IN CONTACT WITH GAS

A. Provide line-size, lever-handle, stopcock of a type designated and approved for handling gas at each gas-consuming appliance.

B. All products bear the AGA and UL label for the use intended.

2.03 METER - BY UTILITY CO.

2.04 PRESSURE REGULATORS

A. Utility Company to provide regulators at meter that provide pressure assigned to serve building (low pressure, 2 PSI or 5 PSI).

B. Plumbing Contractor to provide all regulators required downstream of utility meter/regulator as required to feed all equipment.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Arrange all products to be readily accessible for inspection, testing, and shutting off of gas supply.

B. Install all pipe and fittings clean and free from cuttings, burrs, and defects in structure or threading, and thoroughly brushed and scale blown.

C. All gas piping 2-1/2" and larger, plus any piping run inside building or concealed piping shall be welded (by certified welder). Use chill rings throughout.

D. Do not install any building service low pressure piping in concrete, in masonry, or below grade. Route piping to science lab tables in service trench in slab. Any piping installed below grade is to be sleeved and vented per code.

E. Provide connection at all gas consuming appliances.

F. Provide underground stub up for connection to gas meter as required by Gas Company for meter support.

G. Reference Specification Section 20 01 00, 2.08, C., for roof roller pipe supports. All gas piping **including drip leg** is to be a minimum of 6" above finished roof surface unless noted as needing to be higher than the normal 6" minimum. Top taps off main allow for this.

H. Protect roof during installation.

I. Support all suspended gas piping as follows: 1/2" piping at 4 foot on center; 3/4" piping at 6 foot on center; and piping 1" and larger at 8 foot on center. Reference Section 20 01 00.

J. **Prime and paint all exposed gas piping**. Riser to match building. Verify exact color with the Architect.

K. Provide a wrench operated plug cock valve at building entrance.

L. Install 3" to 6" long drip legs located in accessible position at each piece of equipment for the purpose of accumulating debris, moisture and condensate. They shall be no smaller than the gas main which they drain. End of drip leg shall have a suitably sized threaded malleable iron black cap.

M. Branches feeding more than one piece of equipment can come off side or top of main gas line.

N. **Branches feeding a single piece of equipment must come off top of main gas line or branch**.

O. Slope piping not less than 1/4" in 15 feet to prevent traps. All piping to drain back to meter.

P. Exterior gas regulators to have unions on both sides of regulator and to have vent aimed in downward position to prevent water from collecting/freezing and cracking of regulator housing. Pipe off regulator vent to a point at least 5'-0" away from any unit. Regulators located indoors are to be properly vented to outdoors. End of all vents to have bee screen in it.

Q. Coordinate all gas piping for kitchen equipment with kitchen plans. Provide full-size main behind equipment under hood and provide taps per kitchen equipment drawing. Provide separate isolation valve for each piece of equipment. Install emergency gas shut off valve provided by kitchen equipment supplier in main gas drop to equipment.

R. PURGE/TESTING

1. Test all gas piping before connection to the gas source. Do not enclose or conceal any untested portion of the gas system.

2. Prior to pressure test all gas piping is to be cleaned/purged with compressed air or dry nitrogen at a minimum of 100 psi from end of run(s) back to a point near meter or regulator connection serving building. Shut off stops to each piece of equipment so as not to damage regulators or gas valves in equipment. Open connection at building entry and purge for at least 5 minutes or until all debris is removed. Reconnect piping.

3. Pressure Test all piping in accordance with plumbing code. Test pressure to be 60 psi, soap all joints and repair all leaks.

4. Obtain a certificate of final inspection from the Administrative Authority and provide a letter stating all gas piping has been tested and all leaks repaired.

END OF SECTION

SECTION 23 30 00 - AIR DISTRIBUTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description: This section describes specific requirements, products and methods of execution relating to the project air distribution systems.

B. Provide all air distribution systems as shown and specified, complete in every detail and in perfect operating order.

C. All equipment warranties to be per Specification Section 20 00 00, 1.17.

D. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 Provide all air distribution work in accordance with the minimum provisions of the latest approved editions of the following codes and standards.

A. NFPA 90 A - Air Conditioning and Ventilating Systems.

B. NFPA 90 B - Warm Air Heating and Air Conditioning.

C. SMACNA - Low Velocity Duct Construction Standards.

D. TIMA - Fibrous Glass Duct Construction Standards.

E. SMACNA - Duct Liner Application Standard.

F. SMACNA - Ducted Electric Heat Guide.

G. AMCA Standard 210-74 Laboratory Methods of Testing Fans for Rating Purposes.

H. AMCA Pub. 261 Directory or Products Licensed to Bear the AMCA Certified Rating Seal.

I. AMCA Standard 300-67 Test Code for Sound Rating.

J. AMCA Standard 301-65 Method of Publishing Sound Ratings for Air Moving Devices.

K. AMCA Publication 511-75 Certified Ratings Program for Louvers, Dampers and Shutters.

L. ASHRAE Standard 52-76 Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

M. ASHRAE Standard 70-72 Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.

1.03 Where any references to “sheetmetal work” or “ductwork” appears in this section of these specifications or on the drawings, it shall be construed to include outside air ducts, supply air ducts, return air ducts, exhaust ducts, relief ducts, plenums, duct taps, grille taps, diffuser connections and all other related pieces and parts of the air conveying systems.

1.04 Before starting shop drawings or fabrication of any duct work, the Contractor must have an approved reflected ceiling plan with which he can coordinate location of air outlets, lights, grille patterns, etc.

PART 2 - PRODUCTS

2.01 FANS

A. General Requirements for All Fans:

1. All fans constructed to AMCA Standards, AMCA listed and labeled.

2. Bearings:

a. At factory assembled package units 1HP and larger, provide 200,000 hour bearings (AFBMA L-50) selected at maximum fan rpm.

b. At packaged equipment 3/4HP and smaller, provide manufacturer's standard bearings.

c. Arrange equipment for easy access to lubrication fittings. Provide extended grease lines whenever easy access is not possible.

3. Balance fans statically and dynamically at factory.

4. Factory paint fan housing, fan wheel (except aluminum), frame and support brackets with prime coat and enamel finish coat at factory, after properly preparing surfaces.

5. Arrange fans to be cleanable and so that wheel, bearings, shaft, and drive are removable. Provide plug type cleanout doors or split fan housing. Gasket joints and bolt airtight.

6. Provide vibration isolation for all fans per manufacturer's recommendations.

7. Assemble fans at factory and test with permanent motor for proper operation, alignment and balance.

8. **All fans are to be of similar size and operational characteristics as fans scheduled. Smaller fans run at higher speeds will not be accepted.**

9. All Exhaust and Make-up Air fans to have dampers. If backdraft dampers are not provided as an integral part of the fan provide a motorized parallel blade damper, the operator voltage / phase to match the voltage / phase of the fan that it is serving. If the voltage / phase cannot be matched provide transformers, relays, etc. required to interlock the damper with the fan.

B. Belt Drives (All Belt Driven Fans):

1. Provide V-belt drive with sufficient belts to prevent slipping at start-up. Select drive for 1.5 service factor.

2. On each fan 10HP and smaller, provide variable pitch drive sheave with infinitely adjustable pitch diameter. Select drive sheave and fan pulley combination to provide fan rpm with drive adjusted to near mid-span.

3. Provide belt guard with hinged tachometer cap.

C. Roof Mounted Exhaust Fans:

1. Direct drive or have adjustable pitch v-belt AS SCHEDULED.

2. Wheels shall be backward curved and housing shall be removable or hinged aluminum.

3. Isolate motor with vibration dampeners.

4. Provide with motorized backdraft dampers unless gravity backdraft dampers are specifically listed on schedule. Damper actuator voltage to match fan voltage. Electrical Contractor to tie damper in to fan power.

5. Insulated, pre-fabricated metal roof curb shall be for flat or sloped roof as required for fan to be set level on roof.

6. Provide with galvanized bee screen.

7. Maximum motor rpm is not to exceed scheduled rpm by more than 50 rpm.

8. Provide with 12" high roof curb to match roof slope. Curb to minimum of 12" above finished roof.

9. Manufacturers: Greenheck, Acme, ILG, Penn, Briedert, Carnes and Twin City.

D. Ceiling Exhaust Fans:

1. Centrifugal wheel with inlet perpendicular to, or remote from, inlet grille. Acoustically insulated housing.

2. 85% free open area grille.

3. Electrical junction box on fan housing with cord, plug, and receptacle inside housing.

4. Fan, motor and wheel assembly removable through grille without disturbing housing.

5. Motor mounted on rubber-in-sheer isolators, grounded, maximum rpm shall not exceed scheduled rpm by more than 50 rpm.

6. Unit supplied with grille when indicated by model number scheduled.

7. Provide and install roof cap or wall cap as shown.

8. Unit UL labeled.

9. Integral backdraft damper, shatterproof, with no metal to metal contact.

10. Manufacturers: Greenheck, Acme, ILG, Penn, Briedert, Carnes and Twin City.

2.02 FAN ACCESSORIES

A. Flexible Fan Connectors:

1. Provide at inlet and discharge of each fan, ERV, MAU, air handling unit, etc.

a. For Standard Application:

1) Material suitable to withstand the pressure encountered. Constructed from coated heavy glass fabric, flameproof and ozone resistant. Joints to be sealed airtight. Minimum of 3" flex connection to be used.

2) Manufacturer: Duro-dyne Corporation "EXCELON" or equal.

b. For Outdoor Installations and Where Duct is Exposed to Toxic Fumes:

1) Material suitable to withstand the pressure encountered. Constructed from heavy glass fabric, double coated with "Neoprene", non-combustible and fire retardant. Fabric to be waterproof and airtight. Minimum of 4" flex connection to be used.

2) Manufacturer: Duro-dyne Corporation Duralon or equal.

2. Insulate over flex connection at inlet and discharge of all air handling units and rooftop units with minimum two inch (2") Type "C" insulation with minimum installed "R" value of 6.0. Seal termination of external insulation to ductwork with Childers CP-11 mastic with 3" glass fiber reinforcing mesh. Do not seal over any access panels.

2.03 DUCTWORK

A. Low Velocity Ductwork Systems:

1. Definition: Ductwork systems where duct pressures do not exceed 2" W.G. maximum static pressure and duct velocity does not exceed 2000 FPM. **Minimum duct gauge to be 26 gauge.**

2. All ductwork connected to louvers is to be sloped back to louver to insure that any water entering the duct drains back to the exterior of the building.

3. Ductwork Construction:

a. Ductwork, unless otherwise specified herein, shall be constructed of new, prime grade, continuous hot dip mill galvanized, lock forming quality steel sheets and shall have a galvanized coating of 1-1/4 ounces total for both sides per square foot. The gauges of metal to be used and the methods of duct construction shall conform to the requirements for the class of work involved as set forth in the latest edition of "Standard Practice in Mechanical Sheet Metal" as published by SMACNA. Each sheet shall be stenciled with the gauge and manufacturer's name. If coil steel is used, coils shall be stenciled throughout on ten foot (10') centers with the gauge and manufacturer's name. Insulate per Specification Section 20 07 00.

b. All dimensions are inside clear dimensions. Sheet metal size shall be increased to allow for duct liner where applicable.

c. Seal all transverse joints, seams and fitting connections with "Ductmate Proseal", Childers CP-146 or Foster 32-19, UL listed Mastic to prevent air leakage. Oil base caulking and glazing compounds are not acceptable. Duct sealant must meet VOC units per South Coast Air Quality Management District (SCAQMD) Rule #1168.

4. Rectangular Ducts:

a. Where special rigidity or stiffness is required, construct ducts of metal two gauge numbers heavier.

b. Ducts larger than 96" require special field study for gauging and supporting and supporting methods. (Furnish shop drawings for supporting and construction requirements.)

c. Rectangular low pressure ducts shall be constructed, braced and reinforced in accordance with Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

5. Round Ducts:

   a. Construct round ducts from steel sheets, U.S. Gauge thickness, per SMACNA standards.

   b. All exposed round ducts shall be double wall spiral duct per SMACNA standards with segmented fittings regardless of size.

   c. Supply, return and exhaust duct runouts to/from air device shall be gauges as follows:

      1) up to 12" diameter 30 gauge,

      2) 14" to 18" diameter 28 gauge, and

      3) 20" to 22" diameter 26 gauge.

      Provide minimum 26 gauge, 1" wide strap on heal and throat of adjustable fitting to provide additional rigidity.

6. Transitions:

   a. Provide tapered transitions at changes in duct size and at connections to fans and other equipment.

   b. Offset not more than 20°, on diverging flow and 30° on contracting flow, unless called for otherwise on drawing.

7. Elbows and Turning Vanes:

   a. Use long radius, 45° and 90° fittings for all elbows and at tees, unless otherwise shown or space restrictions dictate use of square elbows.

      1) Construct fittings with centerline radius equal to 1-1/2 times the duct width at the turn.

      2) Where square vaned elbows are used, provide access doors as detailed below.

   b. Turning Vanes: In all 90° turns in supply air ducts where 1-1/2 radius elbows cannot be used, install double radius turning vanes in square elbows.

      1) Ducts 19" and Smaller: Use small double vanes with an inner radius of two inches (2") and an outer radius of one inch (1") mounted on 3/4" center.

      2) Duct 19" and Larger: Use large double vanes with an inner radius of four inches (4") and an outer radius of two inches (2"), mounted on three (3) 1/4" centers. Provide sound reduction type turning vanes: "Airsan" Acoustiturn, by Air Filter Corporation, "Sone-Turn" by Sound Control Products Company, per SMACNA Plat 22, or equal.

      3) Provide 12" x 12" insulated access door into duct on both sides of each vaned fitting to facilitate duct cleaning.

8. Flexible Duct:

   a. Do not use flexible duct except where specifically called for on the plans.

b. At diffuser connections:

1) Provide duct listed as UL-181 Class I air duct, and constructed in compliance with NFPA 90A.

2) Minimum length 4 feet, maximum length 5 feet for supply ducts. Minimum length 4 feet, maximum length 5 feet for return air ducts. Install with not more than one (1) 90 full radius degree bend. Minimum and maximum lengths are to be closely followed since the flex duct acts as the main source of sound attenuation in the air system. Install with some slack in runout.

3) Make joints with Nashua brand UL181A-P Duct Tape (Venture #1599B or Shurtape #PC857) and two (2) 1/2" wide positive locking straps, one on inner core and one on outer jacket. Use Panduit straps.

4) Minimum sound net insertion loss for duct as follows:

BAND, HZ	125	250	500	1000	2000
Loss dB/ft.	2.1	3.0	2.7	3.0	2.7

5) Submit sound and construction data for proposed alternates.

6) Tough vapor barrier reinforced metalized polyester jacket, tear and puncture resistant.

7) Airtight inner core with no fiberglass erosion into airstream.

8) **R-Value: 6.0 @ 75ºF. mean temperature if within building insulation envelope, or R-value of 8.0 if outside building insulation envelope.**

c. Do not use flex duct on exhaust systems.

d. Manufacturers: **Atco 36 Series**, Certainteed, Thermoflex, Wiremold, Genflex, approved equal.

B. Entire interior of ducts shall be thoroughly cleaned of all oil residue and dust prior to installing.

2.04 DUCT ACCESSORIES

A. Air Volume Controls:

1. Provide air volume dampers, or other control devices, at each low pressure duct main and branch for a balancer to adjust the system to produce the air quantities shown.

a. Provide opposed blade damper for balancing in each zone duct for HETD. Locate downstream of first elbow in accessible location and indicate location on record drawings.

2. Volume Dampers:

a. Flat sheet, single leaf damper with a continuous rod; damper leaf two (2) gauges (minimum 16 gauge) heavier than the duct where installed. Provide locking quadrants with indicators located accessible without demolition.

1) Use for supply, return and exhaust ductwork 14" round or 14" x 14".

b. The locking-type quadrant operators for dampers, when installed on ducts to be thermally insulated, shall be provided with **stand-off mounting brackets, bases or adapters to provide clearance, between the duct surface and the operator, not less than the thickness of the insulation.** Stand-off mounting items shall be integral with the operator or a standard accessory of the damper manufacturer. All volume dampers indicated shall be provided with stand-off mounting brackets as required.

c. All operators accessible and lockable. Do not insulate over top of volume damper operator handle.

d. Locate dampers a minimum of 4 feet from diffusers.

3. Extractors:

a. Combination air straightening vanes and volume control with locking quadrant on outside or accessible through face of register.

b. Manufacturer: Titus AG-45 or approved equal.

c. Provide extractors at supply grilles attached directly to any main or branch duct serving more than one (1) grille.

4. Splitter Dampers:

a. Construct damper using sheetmetal blade hinge mounted inside duct.

b. Dampers or splitters shall be constructed from the same gauge metal as the ducts which they serve with a minimum of 22 gauge. Splitter length shall be 1-1/2 times the duct width up to 24” in size and above 24” in size shall be 1-1/4 times the duct width.

c. Attach Duro-dyne SRP-40 series splitter damper bracket to blade.

d. Connect 1/4” steel rod to damper bracket and extend through Duro-dyne SRP-14 ball joint damper casting mounting on outside of duct. Use 3/8” steel rod for splitter in ducts above 24” in size.

e. Install assembly for full swing of damper blade. Lock damper in proper position.

5. Opposed Blade Dampers:

a. Provide opposed blade balancing dampers with multiple blades equal to Greenheck VCD-15, 20 gauge frame and 16 gauge blade construction with synthetic axle bearings and 1/2” diameter operator, complete with 1” stand-off and manual locking quadrant as follows:

1) Use for outside air ductwork. Minimum damper size is actual duct size or 10” x 10”, whichever is larger. Provide transitions as required.

2) Use for supply, return and exhaust ductwork - 14” round or 14” x 14” and larger.

b. Damper material is to match ductwork material. (i.e., galvanized aluminum, stainless steel, etc.)

B. Gravity Backdraft Dampers:

1. Provide backdraft dampers counter balanced to desired static pressure setting. Wide open static pressure drop not to exceed 0.15” W.G.

2. Damper blades aluminum with felt applied to tops of blades. Where dampers are exposed to outside temperature, provide neoprene edged blades.

3. Damper frames extruded aluminum; nylon bearings.

4. Assembly designed for operation at 20°F.

C. Access Panels and Doors:

1. Low Velocity System Access Panels:

a. Sheetmetal doors reinforced, cross-bracketed or otherwise stiffened to prevent rattle or vibration.

b. Seal doors airtight with felt edged gaskets.

c. Secure with hinges and sash locks.

d. Panels and doors for insulated duct systems are to be insulated.

2.05 GRILLES, REGISTERS AND DIFFUSERS

A. Provide grilles, registers, and diffusers of the types and sizes called for on plans and in schedule on drawings.

B. Finish with factory applied finish for extruded aluminum items, and with a prime coat for steel items. (Provide an additional factory baked enamel finish to match ceiling grid.) (Submit color sample for approval.)

C. Equip diffusers with panels of the proper size to match the suspended ceiling layout or with the proper frame for surface mounting. Fully correlate diffuser and grille style, dimension and fit with ceiling.

D. Manufacturers: Price, MetalAire, Titus, Tuttle & Bailey, Krueger, Anemostat, Carnes

E. All air devices located in damp areas are to be constructed from all aluminum components.

F. Provide minimum 12” deep externally insulated boot for sidewall type supply air devices.

G. Provide square to round transitions as required.

H. Provide minimum 12” deep (top duct tap) or 24” deep (side duct tap) externally insulated boot for return air and transfer air devices.

I. Provide minimum 12” deep boot for all exhaust devices.

2.06 LOUVERS AND HOODS

A. Provide air exhausts through building skin, as shown.

B. Louvers:

1. Size as shown; air pressure drop not to exceed 0.15” W.G. when handling 1150 FPM per square foot of free area.

2. Water penetration not to exceed .02 oz. per sq. ft. when handling 1150 FPM per square foot of free area.

3. 4" deep drainable louver constructed of .125" thick 6063-T52 extruded aluminum alloy with channel frame.

4. Provide with 1/8" X 1/8" galvanized hardware cloth bee screen.

5. Finish to be factory primed for field painting or applied .7 mil thick anodized dark bronze as directed by Architect.

6. Manufacturers: Greenheck ESD-403, Arrow, Carnes, Greenheck, Ruskin, Empco, Pottorff, or approved equal.

7. Any plenum or ductwork attached to louver is to slope to drain back through louver to exterior of building.

C. Hoods:

1. Construction of heavy duty aluminum sheets with rolled interlocking seams with galvanized hood support members, similar to Greenheck Fabrahood or equal.

2. Provide with bee screen on outside air intake hoods and 1/4" x 1/4" galvanized bird screen on relief hoods.

3. Curbs are to be a minimum of fourteen inches (14") high above finished roof surface and match slope of roof.

4. Manufacturers: Greenheck, Acme, Penn, Cook, Briedert and Carnes.

5. Provide 120 volt motorized damper.

2.07 AIR FILTERS

A. General:

1. All air filters to be listed as Class 2 by Underwriters Laboratory, Inc., Building Materials Directory.

2. All arrestance, efficiency (dust spot efficiency on atmospheric air) and dust holding capacities specified are to be in accordance with ASHRAE Standard 52-76.

3. Performance characteristics are to be verified by certified data published in manufacturer's literature or by copies of current test data from an independent authorized test laboratory. Test data, where required, shall be an integral component of the manufacturer's submittal data.

4. Provide and install one (1) clean set of filters in all air moving units that require filtration at completion of project.

B. Grease Rated Filters (for all return air filter grilles located in kitchens):

1. Media: Multiple layers of aluminum sheets that are corrugated, slit then expanded into a series of baffles. Media protected on both sides by expanded aluminum grid.

2. Initial Resistance: .06" W.G. at 350 fpm.

3. Frame: Single piece of heavy gauge two inch (2") aluminum u-channel with "compression" flanges that grip the media and lock it to the frame.

4. Filter shall be washable.

5. Manufacturers: American Air Filter, mesh type grease filter or approved equal.

C. Disposable Panel Filters (for return air filter grilles and/or unit filter racks):

1. Media: Non-woven, lofted cotton bonded to 96% free area welded wire support grid. Not less than 2.45 square feet media area per square foot of filter face area. Arranged in radially pleated configuration and bonded continuously to inside perimeter of high wet-strength beverage board cell sides.

2. Cell Design: Two inches (2") deep with beverage board diagonal supports at entering air and leaving air faces of each cell.

3. Air Cleaning Performance: Minimum 25-30% efficiency 90-92% arrestance, MERV-7.

4. Initial Resistance: 0.2" W.G. at 500 fpm face velocity.

5. Dust Holding Capacity: Not less than 200 grams when operated at 500 fpm face velocity to a final resistance of .9 W.G.

6. Manufacturers: Cam-Farr Company Aeropleat II; AAF or approved equal.

D. Temporary Filters:

1. Reference 20 00 00, 3.07 for temporary filter requirements.

2.08 UNIT HEATERS (ELECTRIC)

A. Provide UL listed electric unit heaters with voltage, phase, number of steps, heating and air delivery capacities, as scheduled. Suitable for vertical and horizontal mounting.

B. Casings fabricated of die-formed heavy gauge steel and finished in high gloss baked enamel.

C. Steel finned tubular element. Provide automatic reset thermal cutout for each element.

D. Individually adjustable discharge louvers.

E. Thermostat to match number of heater control steps. Wall mount or built-in as scheduled.

F. Provide angle support between unit heater threaded rod supports and nearest wall to prevent unit sidesway.

G. Manufacturers: Markel, Brasch, Modine, Trane, Berko or approved equal.

2.09 UNIT HEATERS (GAS)

A. Provide AGA label gas-fired unit heaters, power or gravity vented, as scheduled, arranged for ceiling suspension with threaded hanger connections and provided with hanger kits, propeller fan, open drip-proof motor with internal overloads and a safety fan guard. Horizontal directional louvers will be provided for directing air throw.

B. Unit equipped for use with natural gas and 120V power supply. Heat exchanger shall be E-3 409 stainless steel. Die-formed burners are constructed of stainless steel and include flared ports and a stainless steel insert.

C. Provide with a 24V control transformer, a single stage gas control with a regulated combination redundant gas valve and an intermittent safety pilot with electronic ignition and electronic flame supervision. The unit is to include all required limit and safety controls.

D. Provide special air recirculation kit with a manual summer switch on thermostat.

E. Provide angle support between unit heater threaded rod supports and nearest wall to prevent unit sidesway.

F. Manufacturers: Reznor, Modine, Sterling, Hastings, Trane, Lennox or approved equal.

2.10 FIRE DAMPERS

A. Provide and install all fire dampers in all ductwork which passes a fire wall or fire rated ceiling as required by local building and fire safety codes.

B. All dampers folding blade type with no part of blade in the air stream.

C. All fire dampers UL approved and of type required by NFPA 90A.

D. Install all fire dampers per manufacturer's instructions. Installation detail must be submitted with damper submittal. **Post detail at job site in area of building permit.**

E. Provide UL rated sleeves and manufacturer supplied wall angles with damper.

F. Provide four additional fire dampers to be sized and installed as directed by Architect.

G. Manufacturers: Ruskin, Air Balance, Arrow, Greenheck, Nailor or approved equal.

2.11 FIRE/SMOKE DAMPERS

A. Provide and install all fire/smoke dampers in all ductwork which passes through a smoke wall and/or any rated egress pathways, as required by local building and fire safety codes and as indicated on the drawings.

B. All dampers shall have qualified electric operators.

C. All dampers UL approved and of type required by NFPA 90A.

D. Install all dampers per manufacturer's instructions. Installation detail must be submitted with damper submittal. **Post detail at job site in area of building permit.**

E. All dampers shall have a UL555S leakage classification of II.

F. Provide UL rated sleeves and manufacturer supplied wall angles with damper.

G. Provide four additional fire/smoke dampers to be sized and installed as directed by Architect.

H. Manufacturers: Ruskin, Air Balance, Arrow, Nailor, Greenheck or approved equal.

PART 3 - EXECUTION

3.01 LOW VELOCITY DUCTWORK

A. Provide ductwork in accordance with SMACNA low velocity standards.

B. Provide backdraft dampers for all exhaust fans if motor operated dampers are not called for. Provide one inch (1") mesh bird screen at all exhaust discharges.

C. Seal all transverse joints, seams and fitting connections with KINGCO 11-376 "Super Seal" or "Ductmate Proseal", U.L. listed.

D. Where ducts exposed to view, pass through walls, floors or ceilings, furnish and install sheetmetal collars to cover the voids around the duct.

E. This work shall be guaranteed for a period of one (1) year from and after the date of acceptance of the job against noise, chatter, whistling or vibration and free from pulsation under all conditions of operation. After the system is in operation, should these defects occur, they shall either be removed and replaced or reinforced as directed by the Owner.

F. Duct shall be erected in the general locations shown on the drawings, but must conform to all structural and final conditions of the building. Before fabricating any ductwork, the Contractor shall check the physical conditions at the job site, and shall make all necessary changes in cross sections, transitions, offsets, etc., whether they are specifically indicated or not at no additional charge to the Owner.

G. Reinforce all ducts to prevent buckling, breathing, vibration or unnecessary noise, such reinforcing to be as recommended in the SMACNA manual plus any additional reinforcing as may be required to meet job conditions.

H. Provide manually operated volume control dampers (with stand-off mounting brackets for externally insulated ductwork) in all branches, splits and taps for proper balancing of air distribution, whether shown on drawings or not, dampers to be either single blade or multi blade as shown in the SMACNA manual as required. They shall incorporate an indication device with lock to hold damper in position for proper setting.

I. Damper operators in all unfinished areas shall be Young Series 400 of the exact style, type and size required. All other operators shall be Young #315 and/or #896 opposite end from the operator. Where dampers are installed in ducts located above accessible type ceilings, damper operators shall not be extended through the finished ceiling.

J. All square elbows shall have turning vanes per the SMACNA manual requirements.

K. Where ducts connect to fans, including roof exhausters, flexible connections shall be made using “Ventglas” fabric that is fire-resistant, waterproof, mildew-resistant and practically air tight, and shall weigh approximately thirty ounces per square yard. There shall be a minimum of two and one-half inches (2-1/2”) distance between the edges of the ducts. There shall be a minimum of one inch (1”) of slack for each full inch of static pressure on the fan system.

L. Furnish and install screens on all ducts, fans, etc. furnished by the Contractor which lead to, or are outdoors. Screens shall be 16 gauge, three-eighths inch (3/8”) mesh in removable galvanized steel frames.

M. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punches (not pin punches), and shall not be larger than necessary. All duct openings shall be provided with sheetmetal caps if the openings are to be left unconnected for any length of time. All panels of ducts twelve inches (12”) and larger shall be cross broken.

N. Furnish and install a minimum 16 x 16 x 2 internally insulated (foil facing to airstream) filter rack with a hinged type access door with cam or spring lock and filter in all unfiltered raw outside air ducts that connect directly to return air plenums.

O. **All ductwork that is connected to any exterior louver or wall cap, etc. shall be sloped to drain outside.**

3.02 DUCTWORK SUPPORTS

A. Support all ductwork to prevent sag, undue play, and swing. All horizontal ducts shall have a support within 2’ of each elbow and within 4’ of each branch intersection. Provide a hanger within twelve inches (12”) from unit supply and return. Return air plenums on back of air handling units must have a minimum of four (4) support straps.

B. Low Pressure Ductwork:

1. Duct 40" and Less: Provide with 1" x 18 gauge straps fastened to ductwork, and to building construction. Space not more than eight feet (8') on center. Hanger straps shall lap under duct a minimum of one inch (1") and have a minimum of one (1) fastening screw on the bottom and two (2) on the side.

2. Ducts Over 40": Provide mild steel threaded rods fastened to angle iron supports under duct with nuts and to building construction with appropriate inserts, flanges or clamps. Space not more than four feet (4') on center with rods and angle supports as follows:

Angle Length	**Angle**	**Rod Dia.**
4'-0"	1-1/2" x 1-1/2" x 1/8"	1/4"
6'-0"	2" x 2" x 1/8"	1/4"
8'-0"	2" x 2" x 1/8"	3/8"
10'-0"	3" x 3" x 1/8"	3/8"

C. Vertical ducts supported where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles.

D. Recommend methods of fastening bracing to ductwork, including riveting, bolting and tack welding.

E. All flex duct runouts must be properly supported. Use minimum twelve (12) gauge wire with 8" long saddle that fits up to mid point of duct for support of flex duct. **Web Type fabric duct support is strictly prohibited**. Maximum permissible sag is 1/2" per foot of spacing between supports.

F. Provide 1" x 20 gauge straps, minimum 8' - 0" o.c. for all round sheetmetal runouts that are 18" in diameter or less (except Spiral Ducts).

G. Spiral ductwork is to be supported with 2" x 18 gauge strap bands around duct with a 3/8" bolt and nut connection at top. Connect to structure with minimum 3/8" all thread rods, minimum 8'-0" o.c.

3.03 ACCESS

A. Furnish all fans with consideration of location of motor and drive.

B. Furnish and install in the ductwork, hinged access doors to provide access to all manual and automatic dampers, fusible links, cleaning operations, etc. Where the ducts are insulated, the access doors shall be double skin doors with one inch (1") of insulation in the door. In rectangular ducts larger than twenty inches (20") in their smallest dimension, install access doors every twenty feet (20'). Where the size of the duct permits, the doors shall be eighteen inches (18") by sixteen inches (16"). Factory fabricated doors as manufactured by Milcor meeting these specifications will be acceptable. Access doors shall be submitted for approval.

C. Each fire damper door shall have a label with letters not less than 1/2" in height reading **"Fire Damper"**, **"Corridor Ceiling Fire Smoke Damper"** or "**Fire/Smoke Damper"** (as applicable).

D. Cycle damper after installation to insure free movement. Seal opening around fire damper with non-combustible material to maintain integrity of one (1) hour fire wall.

E. Provide access door in supply air and return air drops from rooftop units. Access door to be in accessible location directly above first elbow. Access doors to be 18" X 18" minimum where duct size allows. Access doors shall be shown on ductwork shop drawings.

F. Provide access doors for maintenance inspection and cleaning in each zone duct for HETD. Locate downstream of first elbow in accessible location and indicate location on record drawings.

3.04 Fully coordinate and work directly with the Balancing and Testing Agency to provide all systems in perfect operating order. Make corrections and adjustments as required by the Balancing and Testing Agency in a timely manner.

3.05 For Each Dryer: Provide 4" diameter or 5" x 3" rectangular flue pipe up through the wall and ceiling cavity and terminate into Briedert Cap. Provide transitions as required. Provide 4" diameter tie in point for residential type dryer or stacked washer dryer as required.

3.06 **CAP OPEN ENDS OF ALL DUCTS (INCLUDING SPIN-INS) AND EQUIPMENT WITH MINIMUM FOUR (4) MIL. PLASTIC TO PREVENT CONSTRUCTION DEBRIS AND DUST FROM ENTERING OPENINGS AT ALL TIMES DURING CONSTRUCTION.**

END OF SECTION

SECTION 23 30 01 – SPECIAL DUCT SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Description: This section describes specific requirements, products and methods of execution relating to the project air distribution systems.

B. Provide all air distribution systems as shown and specified, complete in every detail and in perfect operating order.

C. All equipment warranties to be per Specification Section 20 00 00, 1.17.

D. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

1.02 Provide all air distribution work in accordance with the minimum provisions of the latest approved editions of the following codes and standards.

A. NFPA 90 A - Air Conditioning and Ventilating Systems.

B. NFPA 90 B - Warm Air Heating and Air Conditioning.

C. SMACNA - Low Velocity Duct Construction Standards.

D. TIMA - Fibrous Glass Duct Construction Standards.

E. SMACNA - Duct Liner Application Standard.

F. SMACNA - Ducted Electric Heat Guide.

G. AMCA Standard 210-74 Laboratory Methods of Testing Fans for Rating Purposes.

H. AMCA Pub. 261 Directory or Products Licensed to Bear the AMCA Certified Rating Seal.

I. AMCA Standard 300-67 Test Code for Sound Rating.

J. AMCA Standard 301-65 Method of Publishing Sound Ratings for Air Moving Devices.

K. AMCA Publication 511-75 Certified Ratings Program for Louvers, Dampers and Shutters.

L. ASHRAE Standard 52-76 Method of Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

M. ASHRAE Standard 70-72 Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.

1.03 Where any references to “sheetmetal work” or “ductwork” appears in this section of these specifications or on the drawings, it shall be construed to include outside air ducts, supply air ducts, return air ducts, exhaust ducts, relief ducts, plenums, duct taps, grille taps, diffuser connections and all other related pieces and parts of the air conveying systems.

1.04 Before starting shop drawings or fabrication of any duct work, the Contractor must have an approved reflected ceiling plan with which he can coordinate location of air outlets, lights, grille patterns, etc.

PART 2 - PRODUCTS

2.01 KITCHEN EXHAUST SYSTEM

A. General: Provide kitchen exhaust system that complies with all local, state and federal codes. Slope horizontal duct 1" per foot toward hood.

B. Duct Construction:

1. All Type I kitchen exhaust duct is to be 18 gauge stainless steel; all seams and joints made with continuous grease tight weld. Stainless steel where exposed in kitchen with weld seams ground smooth and polished to be compatible with adjacent stainless steel kitchen equipment. Type I kitchen hood exhaust duct alternate: At Contractors option, concealed ductwork may be constructed of 16 gauge black steel with seams and joints same as above.

2. All Type II kitchen exhaust ducts, including dishwasher exhaust are to be constructed from minimum 18 gauge stainless steel sheets. All seams and joints to be made with continuous liquid tight weld. Grind smooth and polish welds on stainless steel ducts.

C. Access:

1. Provide grease rated access doors on side of duct as required for Type I grease rated exhaust duct systems.

2. Provide hinged curb for roof mount exhaust fan.

D. Exhaust Fan on roof to discharge at a minimum 40" above roof line.

E. Provide one (1) hour fire rated gypsum board enclosure around duct (Reference Architectural) (or insulate Type I Kitchen Exhaust with Type "F" insulation to achieve a 1 hour rated enclosure, when allowed by local code authority having jurisdiction). This includes any portion of hood extending above ceiling line.

PART 3 - EXECUTION

3.01 LOW VELOCITY DUCTWORK

A. Provide ductwork in accordance with SMACNA low velocity standards.

B. Provide backdraft dampers for all exhaust fans if motor operated dampers are not called for. Provide one inch (1") mesh bird screen at all exhaust discharges.

C. Seal all transverse joints, seams and fitting connections with KINGCO 11-376 "Super Seal" or "Ductmate Proseal", U.L. listed.

D. Where ducts, exposed to view, pass through walls, floors or ceilings, furnish and install sheetmetal collars to cover the voids around the duct.

E. This work shall be guaranteed for a period of one (1) year from and after the date of acceptance of the job against noise, chatter, whistling or vibration and free from pulsation under all conditions of operation. After the system is in operation, should these defects occur, they shall either be removed and replaced or reinforced as directed by the Owner.

F. Duct shall be erected in the general locations shown on the drawings, but must conform to all structural and final conditions of the building. Before fabricating any ductwork, the Contractor shall check the physical conditions at the job site, and shall make all necessary changes in cross sections, transitions, offsets, etc., whether they are specifically indicated or not at no additional charge to the Owner.

G. Reinforce all ducts to prevent buckling, breathing, vibration or unnecessary noise, such reinforcing to be as recommended in the SMACNA manual plus any additional reinforcing as may be required to meet job conditions.

H. Provide manually operated volume control dampers (with stand-off mounting brackets for externally insulated ductwork) in all branches, splits and taps for proper balancing of air distribution, whether shown on drawings or not, dampers to be either single blade or multi blade as shown in the SMACNA manual as required. They shall incorporate an indication device with lock to hold damper in position for proper setting.

I. Damper operators in all unfinished areas shall be Young Series 400 of the exact style, type and size required. All other operators shall be Young #315 and/or #896 opposite end from the operator. Where dampers are installed in ducts located above accessible type ceilings, damper operators shall not be extended through the finished ceiling.

J. All square elbows shall have turning vanes per the SMACNA manual requirements.

K. Where ducts connect to fans, including roof exhausters, flexible connections shall be made using "Ventglas" fabric that is fire-resistant, waterproof, mildew-resistant and practically air tight, and shall weigh approximately thirty ounces per square yard. There shall be a minimum of two and one-half inches (2-1/2") distance between the edges of the ducts. There shall be a minimum of one inch (1") of slack for each full inch of static pressure on the fan system.

L. Furnish and install screens on all ducts, fans, etc. furnished by the Contractor which lead to, or are outdoors. Screens shall be 16 gauge, three-eighths inch (3/8") mesh in removable galvanized steel frames.

M. All holes in ducts for damper rods and other necessary devices shall be either drilled or machine punches (not pin punches), and shall not be larger than necessary. All duct openings shall be provided with sheetmetal caps if the openings are to be left unconnected for any length of time. All panels of ducts twelve inches (12") and larger shall be cross broken.

N. Furnish and install a minimum 16 x 16 x 2 internally insulated (foil facing to airstream) filter rack with a hinged type access door with cam or spring lock and filter in all unfiltered raw outside air ducts that connect directly to return air plenums.

O. **All ductwork that is connected to any exterior louver or wall cap, etc. shall be sloped to drain outside.**

3.02 DUCTWORK SUPPORTS

A. Support all ductwork to prevent sag, undue play, and swing. All horizontal ducts shall have a support within 2' of each elbow and within 4' of each branch intersection. Provide a hanger within twelve inches (12") from unit supply and return. Return air plenums on back of air handling units must have a minimum of four (4) support straps.

B. Low Pressure Ductwork:

1. Duct 40" and Less: Provide with 1" x 18 gauge straps fastened to ductwork, and to building construction. Space not more than eight feet (8') on center. Hanger straps shall lap under duct a minimum of one inch (1") and have a minimum of one (1) fastening screw on the bottom and two (2) on the side.

2. Ducts Over 40": Provide mild steel threaded rods fastened to angle iron supports under duct with nuts and to building construction with appropriate inserts, flanges or clamps. Space not more than four feet (4') on center with rods and angle supports as follows:

Angle Length	Angle	Rod Dia.
4'-0"	1-1/2" x 1-1/2" x 1/8"	1/4"
6'-0"	2" x 2" x 1/8"	1/4"
8'-0"	2" x 2" x 1/8"	3/8"
10'-0"	3" x 3" x 1/8"	3/8"

C. Vertical ducts supported where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles.

D. Recommend methods of fastening bracing to ductwork, including riveting, bolting and tack welding.

E. All flex duct runouts must be properly supported. Use minimum twelve (12) gauge wire with 8" long saddle that fits up to mid point of duct for support of flex duct. **Web Type fabric duct support is strictly prohibited**. Maximum permissible sag is 1/2" per foot of spacing between supports.

F. Provide 1" x 20 gauge straps, minimum 8' - 0" o.c. for all round sheetmetal runouts that are 18" in diameter or less (except Spiral Ducts).

G. Spiral ductwork is to be supported with 2" x 18 gauge strap bands around duct with a 3/8" bolt and nut connection at top. Connect to structure with minimum 3/8" all thread rods, minimum 8'-0" o.c.

3.03 ACCESS

A. Furnish all fans with consideration of location of motor and drive.

B. Furnish and install in the ductwork, hinged access doors to provide access to all manual and automatic dampers, fusible links, cleaning operations, etc. Where the ducts are insulated, the access doors shall be double skin doors with one inch (1") of insulation in the door. In rectangular ducts larger than twenty inches (20") in their smallest dimension, install access doors every twenty feet (20'). Where the size of the duct permits, the doors shall be eighteen inches (18") by sixteen inches (16"). Factory fabricated doors as manufactured by Milcor meeting these specifications will be acceptable. Access doors shall be submitted for approval.

C. Each fire damper door shall have a label with letters not less than 1/2" in height reading **"Fire Damper"**, **"Corridor Ceiling Fire Smoke Damper"** or "**Fire/Smoke Damper"** (as applicable).

D. Cycle damper after installation to insure free movement. Seal opening around fire damper with non-combustible material to maintain integrity of one (1) hour fire wall.

E. Provide access door in supply air and return air drops from rooftop units. Access door to be in accessible location directly above first elbow. Access doors to be 18" X 18" minimum where duct size allows. Access doors shall be shown on ductwork shop drawings.

F. Provide access doors for maintenance inspection and cleaning in each zone duct for RTUMZ. Locate downstream of first elbow in accessible location and indicate location on record drawings.

3.04 Fully coordinate and work directly with the Balancing and Testing Agency to provide all systems in perfect operating order. Make corrections and adjustments as required by the Balancing and Testing Agency in a timely manner.

3.05 For Each Dryer: Provide 4" diameter or 5" x 3" rectangular flue pipe up through the wall and ceiling cavity and terminate into Briedert Cap. Provide transitions as required. Provide 4" diameter tie in point for residential type dryer or stacked washer dryer as required.

3.06 **CAP OPEN ENDS OF ALL DUCTS (INCLUDING SPIN-INS) AND EQUIPMENT WITH MINIMUM FOUR (4) MIL. PLASTIC TO PREVENT CONSTRUCTION DEBRIS AND DUST FROM ENTERING OPENINGS AT ALL TIMES DURING CONSTRUCTION.**

END OF SECTION

SECTION 23 70 06 - VARIABLE REFRIGERANT VOLUME (VRV) CONTROLS

PART 1 - GENERAL

1.01 Physical characteristics

General:
The advanced multi-zone controller shall be made from plastic materials with a neutral color. Each control shall have a LCD (Liquid Crystal Display) that shows On/Off, setpoint, room temperature, mode of operation (Cool/Heat/Dry/Fan/Auto), louver position, and fan speed.

1.02 Electrical characteristics

A. General:

The advanced multi-zone controller will require 24 VAC to power the controller. The advanced multi-zone controller shall supply 16 volts DC to the communication bus on the F1F2 (out-out) terminal of the outdoor unit. The voltage may rise or fall in relation to the transmission packets that are sent and received.

B. Wiring:

The advanced multi-zone controller communication wiring shall be terminated in a daisy chain design at the outdoor unit, which is then daisy chained to branch selector (Heat Recovery system), then daisy chained to each indoor unit in the system and terminating at the farthest indoor unit. The termination of the wiring shall be non-polar. The remote control wiring shall run from the indoor unit control terminal block to the remote controller connected with that indoor unit.

C. Wiring size:

Wiring shall be non-shielded, 2-conductor sheathed vinyl cord or cable, and 18 AWG stranded copper wire.

PART 2 - PRODUCTS

2.01. Advanced Multi-zone Controllers

The Daikin AC VRV advanced multi-zone controllers are compatible with all VRV, SkyAir, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. The advanced multi-zone controller wiring consists of a non-polar two-wire connection to the outdoor unit. The advanced multi-zone controllers may be wall-mounted and can be adjusted to maintain the optimal operation of up to 64 connected indoor unit groups and 128 indoor units. Set temperatures can be adjusted in increments of 1°F. In the cases where a system or unit error may occur, the VRV controllers will display a two-digit error code and the unit address.

A. DCM601A71: intelligent Touch Manager (iTM) V. 1.02

The intelligent Touch Manager (version 1.02) shall provide control for all VRV, SkyAir, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. It shall be capable of controlling a maximum or 64 indoor unit groups and 128 indoor units connected to a maximum of 10 outdoor units. The intelligent Touch Manager shall support operations superseding that of the local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.

The controller wiring shall consist of a non-polar two-wire connection to the indoor unit at terminals F1F2 (out-out) of the outdoor unit. The intelligent Touch Manager is wall mounted and can be adjusted to maintain the optimal operation of the connected indoor unit(s).

The intelligent Touch Manager can be used in conjunction with the BRC1E71 (Navigation Remote Controller) Manual addressing is required of each remote controller group associated with the intelligent Touch Manager. DIII-NET address can be set for one (1) indoor unit or each indoor unit in the remote controller group.

The intelligent Touch Manager shall be equipped with two RJ-45 Ethernet ports to support interconnection with a network PC via the Internet, Local Area Network (LAN), or connection with a non-networked PC after completed installation.

Web access functions shall be available so that facility staff can securely log into each Intelligent Touch Manager via the PC's web browser to support monitoring, scheduling, error email, and general user functions. Additional optional software functions of Power Proportional Distribution tenant billing and Energy Navigator shall also be available. The optional software shall require advanced purchase and can only be activated upon receipt of a license activation key from Daikin AC.

1. Mounting:

   The intelligent Touch Manager shall be mounted on the wall or into the mounting fixtures included with the intelligent Touch Manager.

2. Display Features:

   a. The intelligent Touch Manager shall be approximately 11.42" x 9.57" x 1.97' in size with a backlit 10.4" LCD display.

   b. Display information shall be selectable from English, French, Italian, Korean, Dutch, Portuguese, Chinese, Japanese, German, or Spanish.

   c. Featured backlit LCD with auto off after 30 minutes (default) is adjustable between 1 to 60 minutes, or the choice of 3 different screen savers.

   d. Area and Group configuration

      1) Area contains one (1) or more Area(s) or Group(s)

      2) A Group may be an indoor unit, Di, Dio point that has a DIII-NET address

   e. An Area is a tiered group where management points (indoor unit, digital input/output, and analog input groups) can be monitored and controlled by global settings. Up to 650 Areas can be created. Area hierarchy can have up to 10 tiered levels (ex. top level: 1st floor West, 2nd level: offices, hallways, 3rd level: Office 101, 102, and 103, etc.). Area configuration shall classify levels of monitoring and control for each management point.

      1) Areas and Groups may be assigned names (ex. Office 101, Lobby, North Hallway, etc.)

   f. The Controller shall display On/Off, Operation Mode, Setpoint, Space Temperature, Louver Position, Fan Speed for each Area or Group.

g. The Controller shall display Date (mm/dd/yyyy, yyyy/mm/dd, or dd/mm/yyyy format selectable) and day of the week along with the time of day (12hr or 24hr display selectable).

h. The Controller shall adjust for daylight savings time (DST) automatically.

i. Display information shall be updated every 3 seconds to show the latest status of the indoor unit groups.

j. System status icons shall display On/Off (color coded), Malfunction/Error (color coded), Forced Stop, Setback, Filter, Maintenance, and Screen Lock.

k. The controller shall display the temperature setpoint in one degree increments with a range of 60°F – 90°F, 1°F basis (16°C – 32°C, 0.1°C basis).

1) Display of temperature setpoint information shall be configurable for Fahrenheit or Celsius

l. Display shall reflect room temperature -58°F – 248°F, 1°F basis (-50°C – 120°C, 0.1°C basis) range in one degree increment.

1) Display of room temperature information shall be configurable for Fahrenheit or Celsius

m. The Menu List shall be used to configure options and display information for each Area or Group.

n. Error status shall be displayed in the event of system abnormality/error with one of three color coded icons placed over the indoor unit icon or lower task bar.

1) System errors are generated when the intelligent Touch Manager system with other VRV controls systems combined or power proportional distribution calculation errors occur. The intelligent Touch Manager shall display the error with a red triangle placed on the lower task bar

2) Unit errors occurring within the VRV system shall be displayed with a yellow triangle placed over the indoor unit icon

3) Limit errors are based upon preconfigured analog input upper and lower limit settings and are generated when the limits have been met. When limit error is generated a yellow triangle will be placed over the unit icon.

4) Communication errors between the intelligent Touch Manager and the indoor units shall be displayed with a blue triangle placed over the indoor unit icon

5) Error history shall be available for viewing for up to 500,000 errors/abnormality events

o. Floor plan layout

1) Capable of displaying site floor plan as the background for visual navigation. Indoor unit, DIII-NET Di and Dio, and External Di, DO, and Ai icons with operational status can be placed on the floor layout

a) Up to 4 status points can be assigned to the indoor unit icon (room name, room temperature, setpoint, and mode)

b) Digital input and output icons will display On/Off status

c) Analog input icons will display analog value

2) Up to 60 floor layout sections can be created

3. Basic Operation:

a. Capable of controlling by Area(s) or Group(s)

b. Controller shall control the following group operations:

1) On/Off

2) Operation Mode (Cool, Heat, Fan, Dry, and Auto)

3) Setpoint for current mode in the occupied period

4) Controller shall be able to limit the user adjustable setpoint ranges individually for cooling and heating based upon the Area or Group configurations

5) Relative Setup (Cooling) and Setback (Heating) setpoints in the unoccupied mode adjustable to 2 - 12^0F (1 - 7^0C)

a) The high and low relative setback setpoints

b) Setup and Setback setpoints can be set inside or outside of the occupied setpoint range

c) The recovery differential shall be 4^0F (default) and adjustable between 2 – 10^0F

d) Settings shall be applied based upon the Area or Group configurations

6) Fan Speed

a) Up to 3 speeds (dependent upon indoor unit type)

7) Louver direction (dependent upon indoor unit type)

a) 5 fixed positions or swing position

8) Remote controller permit/prohibit of On/Off, Mode, and Setpoint

9) Lock out setting for Intelligent Touch Manager display

10) Indoor unit Group/Area assignment

c. Capable of providing battery backup power for the clock at least 1 year when no AC power is applied.

1) The battery can last at least 13 years when AC power is applied

2) Settings stored in non-volatile memory

4. Programmability:

   a. Controller shall support weekly schedule settings.

      1) 7 day weekly pattern

      2) The schedule shall have the capabilities of being enabled or disabled

      3) 100 independent schedules configurable with up to 20 events settable for each day's schedule

         a) Each scheduled event shall specify time and target Area or Group

         b) Each scheduled event shall include On/Off, Operation Mode, Occupied Setpoint, Pre-Cool, Pre-Heat, Setback High, Setback Low, Remote Controller On/Off Prohibit, Remote Controller Mode Prohibit, Remote Controller Setpoint Prohibit, Timer Extension Setting, Fan Speed, and Setpoint Range Limit

            - Setpoint when unit is On (occupied)

            - Configurable Setup (Cooling) and Setback (Heating) setpoints when unit is Off (unoccupied)

         c) Time setting in 1-minute increments

         d) Timer Extension shall be used for a timed override (settable from 30 – 180 minutes) to allow indoor unit operation during the unoccupied period

      4) A maximum of 40 exception days can be schedule on the yearly schedule (repeats yearly)

         a) Exception days shall be used to override specified days on the weekly schedule based upon irregular occupied/unoccupied conditions

         b) Exception days can be configured on a set date (Jan 1) or floating date (1st Monday in September)

   b. Controller shall support auto-changeover.

      1) Auto-change shall provide Fixed, Operating, and Averaging changeover methods for both Heat Pump and Heat Recovery systems based upon the changeover group configuration. This will allow for the optimal room temperature to be maintained by automatically switching the indoor unit's mode between Cool and Heat in accordance with the room temperature and setpoint

         a) When selecting the Auto-changeover method the Differential should also be set (default value 4°F, adjustable between 0 – 13°F). The (Thermal) Differential is the tolerance for the indoor unit's setpoint.

- When the difference between the representative room temperature and the representative indoor unit setpoint exceed the thermal differential, the operation mode is changed

b) When the mode is changed from Cool to Heat the setpoint will be decreased by the thermal differential set in the Auto Changeover configuration (ex. If the mode is Cool with a 74^{o}F setpoint and a changeover differential of 4^{o}F, when switched from Cool to Heat the new setpoint for heating will be 70^{o}F)

c) When the mode is changed from Heat to Cool the setpoint will be increased by the thermal differential set in the Auto Changeover configuration (ex. If the mode is Heat with a 72^{o}F setpoint and a changeover differential of 4^{o}F, when switched from Heat to Cool the new setpoint for cooling will be 76^{o}F)

2) Fixed method

a) Changeover evaluated by room temperature and setpoint of the representative indoor unit (first registered indoor unit in group) in the changeover group even when it is not operating (must be in Cool, Heat, or Auto mode)

3) Operating method

a) Changeover evaluated by searching for an indoor unit group that is operating in Cool, Heat, or Auto mode and uses the indoor unit room temperature and setpoint as the representative room temperature and setpoint

b) The order of the search is based upon the order each indoor unit group is assigned to the intelligent Touch Manager within the changeover group

c) If none of the indoor units in the group meet the above requirements, the Fixed method of changeover will be applied

4) Average method

a) Changeover evaluated by the average of all indoor unit group's room temperatures and setpoints operating in Cool, Heat, or Auto mode in the changeover group list

b) If none of the indoor units in the group meet the above requirements, the Fixed method of changeover will be applied

c) If the average room temperature ≤ average setpoint, the indoor units will be placed in Heat mode

d) If the average room temperature ≥ average setpoint, the indoor units will be placed in Cool mode

5) Changeover shall change the operation mode of the indoor unit that is set as the Changeover Master. The Changeover Master indoor unit shall then change the operation mode of all indoor unit groups daisy chained to the same outdoor unit in the Heat Pump system or branch selector box in the Heat Recovery system.

6) Changeover from heat to cool mode shall occur when the room temperature is great than or equal to the heating setpoint, plus the setting of the thermal difference (0 – 13ºF) with a safety allowance if necessary is established

7) Changeover from cool to heating mode shall occur when room temperature is less than or equal to the cooling setpoint, minus the setting of the thermal difference (0 – 13ºF) with a safety allowance if necessary is established

8) 30 minute guard timer

a) Upon changeover, guard timer will prevent another changeover during this period.

b) Guard timer is ignored by a change of setpoint manually from either intelligent Touch Manger or Remote Controller or by schedule.

c. Controller shall support Interlock

1) Interlock feature for use with 3rd party equipment (DOAS, dampers, occupancy sensing, etc…) to automatically control Groups or Areas corresponding to the change of the operation states or the On/Off states of any Group.

2) Digital Input/Output (DEC102A51-US2) unit or Digital Input (DEC101A51-US2) unit

a) On/Off based monitoring and control of equipment

b) Manual or scheduled operation of equipment

c) Operation based upon interlock with VRV indoor unit group(s)

d) Monitor equipment error/alarm status

d. Controller shall support force shutdown of associated indoor unit groups.

5. Web/Email Function

a. Each intelligent Touch Manager shall be capable of monitoring, operating, and scheduling a maximum of 64 indoor unit groups (up to 512 indoor unit groups with the addition of the iTM Plus Adapter) from a networked PC's web browser. It shall also be capable of creating general user access and sending detailed error emails to a customized distribution list (up to 10 email addresses).

b. All PCs shall be field supplied

B. DCM601A72: iTM Plus Adapter

The iTM Plus Adapter shall provide control for all VRV, SkyAir indoor units, and Daikin RA and FTXS indoor units with the use of the KRP928BB2S RA Adapter. It shall be capable of handling a maximum of 64 indoor unit groups and 128 indoor units connected to a maximum of 10 outdoor units. The iTM Plus Adapter is to be used in conjunction with intelligent Touch Manager. Up to 7 iTM Plus Adapters can be connected to a single intelligent Touch Manager. This combination will provide intelligent Touch Manager monitoring and control of up to 512 indoor unit groups, 1024 indoor units, and 80 outdoor units. The iTM Plus Adapter shall support operations superseding that of the local remote controller, system configuration, daily/weekly scheduling, monitoring of operation status, and malfunction monitoring.

The controller wiring shall consist of a non-polar two-wire connection to the outdoor unit at terminals F1F2 (out-out). The iTM Plus Adapter is wall mounted and is used in conjunction with the intelligent Touch Manager to maintain the optimal operation of the connected indoor unit(s). The iTM Plus Adapter is connected to the intelligent Touch Manager via a polarity sensitive 18-2 AWG stranded non-shielded wire (field supplied).

The iTM Plus Adapter can be used in conjunction with the BRC1E71 (Navigation Remote Controller), The remote controller shall require daisy chain wiring for grouping multiple indoor units (up to 16) together. Manual addressing is required of each indoor unit group associated with the iTM Plus Adapter.

1) Mounting:

   a) The iTM Plus Adapter can be mounted on the wall or in a standard enclosure (field supplied).

2) Features:

   a) The iTM Plus Adapter shall be approximately 6.30” x 5.87” x 2.41” in size.

3) Basic Operation:

   a) Control of all associated indoor unit groups shall be done via the connected intelligent Touch Manager.

4) Programmability:

   a) Programming of all associated indoor unit groups shall be done via the connected intelligent Touch Manager.

END OF SECTION

SECTION 23 70 71 – DAIKIN SPLIT SYSTEMS

PART 1 – GENERAL

VARIABLE REFRIGERANT FLOW (VRF) AIR CONDITIONING
SPECIFICATION – Heat Pump

1.01 SYSTEM DESCRIPTION

A. The variable capacity, heat pump air conditioning system shall be a Variable Refrigerant Flow (heat and cool model) split system as specified. The system shall consist of multiple evaporators, branch selector boxes, piping joints and headers, a two pipe refrigeration distribution system using PID control, and VRF outdoor unit. The outdoor unit is a direct expansion (DX), air-cooled heat pump, multi-zone air-conditioning system with variable speed inverter driven compressors using R-410A refrigerant. The outdoor unit may connect an indoor evaporator capacity up to 200% of the outdoor condensing unit capacity. All zones are each capable of operating separately with individual temperature control. A dedicated hot gas pipe shall be required to ensure optimum heating operation performance.

B. The outdoor unit shall be interconnected to indoor unit models that range in capacity from 7,500 Btu/h to 96,000 Btu/h. The indoor units shall be connected to the outdoor utilizing specified piping joints and headers. Each indoor unit or group of indoor units shall be independently controlled.

C. Operation of the system shall permit either individual cooling or heating of each indoor unit simultaneously or all of the indoor units associated with one branch cool/heat selector box. Each indoor unit or group of indoor units shall be able to provide set temperature independently via a local remote controller, a centralized controller or a BMS interface.

D. Branch selector boxes shall be located as shown on the drawing. The branch selector boxes shall have the capacity to control up to 96 MBH (cooling) downstream of the branch selector box. The branch selector box shall consist of five electronic expansion valves, refrigerant control piping and electronics to facilitate communications between the branch selector box and main processor and between the branch selector box and indoor units. The branch selector box shall control the operational mode of the subordinate indoor units. The use of five EEV's ensures continuous heating during defrost, no heating impact during changeover and reduced sound levels.

1.02 EQUIPMENT REQUIREMENTS

A. Voltage Platform – Condensing units shall be available with a 460V/3/60, 208/230V/3/60 and 208/230V/1/60 power supply. Some features only available on three phase outdoor units.

B. Auto-charging – Each system shall have a refrigerant auto-charging function.

C. Charge Checking – Each system shall have a refrigerant charge checking function.

D. Defrost Heating – Each system shall maintain continuous heating during defrost operation. If system is not capable of continuous heating during defrost supplier shall add supplemental heat strips at no additional cost to the owner; must coordinate with Electrical Engineer and Electrical Sub Contractors prior to bid.

E. Oil Return Heating – Each system shall maintain continuous heating during oil return operation. If system is not capable of continuous heating during oil return supplier shall add supplemental heat strips at no additional cost to the owner; must coordinate with Electrical Engineer and Electrical Sub Contractors prior to bid

F. VFD Inverter Control – Each condensing unit shall use a high efficiency, variable speed "inverter" compressor coupled with inverter fan motors. Digital scroll compressors are not acceptable.

1.03 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL), in accordance with ANSI/UL 1995 – Heating and Cooling Equipment and bear the Listed Mark.

B. All wiring shall be in accordance with the National Electric Code (NEC).

C. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

D. Mechanical equipment for wind-born debris regions shall be designed in accordance with ASCE 7-2002 and installed to resist the wind pressures on the equipment and the supports.

E. The outdoor unit will be factory charged with R-410A.

F. All capacities and efficiencies shall be rated in accordance with AHRI.

PART 2 – WARRANTY

2.01 WARRANTY

A. The units shall have the manufacturer's parts warranty for a period of ten (10) years from date of installation. All compressors shall have a parts warranty of ten (10) years (total) from date of installation. All warranty service work shall be performed by a factory trained service professional. Warranty shall be administered by the manufacturer or local manufacturer's representative. All service persons shall be factory trained and certified with a minimum of 3 years documented experience with the installed manufacturer's equipment. If the manufacturer or local distribution representative does not have a local service department, then the contractor shall assume all warranty obligations during this period. If warranty is a "contractor warranty" then it shall be clearly indicated in the equipment submittal. The contractor's factory certification shall be provided in the equipment submittal.

2.02 INSTALLATION REQUIREMENTS

A. The system must be installed by a factory trained contractor/installer. The bidders shall be required to submit training certification proof prior to award of contract. Should the installing contractor use a manufacturer other than the basis of design, all coordination related to differences between basis of design and the alternate manufacturer shall be the responsibility of the installing contractor including any required additional evaluation requirements by the engineering firm.

1. Factory Certified witness of breaking of line set vacuum.

2. Factory QC Walks with installing contractor at the following intervals:

   a. Pre-piping and wiring

   b. Twice during piping rough-in, and wiring rough-in

   c. During Vacuum and pressure testing

   d. Pre-startup

3. Full Factory Start-up Required

   a. Service Checker data and temperatures for all fan Coil

   b. Piping Lengths with additional refrigerant required

c. Visual Inspection for cleanliness

4. Daikin Service Checker and Inverter analyzer tools to be conveyed to owner at closeout

5. Manufacture to offer 24 hours of onsite training to site based service and maintenance personnel. Topics to cover basic maintenance, trouble shooting and diagnostic data interpretation.

2.03 PARTS AVAILABILITY

A. The installed system shall have a minimum of one local parts distributor with local (within 90 miles) stock of all critical components. Local availability shall include all fan blades, fan motors, compressors, circuit boards, valves, sensors, etc. If local stock of parts is not available, the manufacturer shall provide all warranty parts with next day freight availability at no additional cost to the owner for 5 years. Unless parts are stocked locally, the owner shall be provided with the following spare parts at no additional cost (to be delivered at startup):

1. Compressor of each size used on the project

2. Fan blade for each style used on the project (condenser and all FCU)

3. Circuit board for each model FCU and ACCU used

PART 3 – PERFORMANCE

3.01 DESIGN BASIS

A. The HVAC equipment basis of design is Daikin AC. All bidders shall furnish the minimum system standards as defined by the base bid model numbers, model families or as otherwise specified herein (see Key General Specifications Alternate Supplier Checklist). In any event, the contractor shall be responsible for all specified items and intents of this document without further compensation.

B. Alternate manufactures may be acceptable provided items detailed in Part 5 VRF HVAC EQUIPMENT ALTERNATE, are met.

PART 4 – PRODUCTS

4.01 OUTDOOR/CONDENSING UNIT

A. Outdoor/Condensing units: Air-cooled DX refrigeration units, designed specifically for use with indoor/evaporator units; factory assembled and wired with all necessary electronics and refrigerant controls; modular design for ganging multiple units.

1. Refrigeration Circuit: Scroll compressors, motors, fans, condenser coil, electronic expansion valves, solenoid valves, 4-way valve, distribution headers, capillaries, filters, shut-off valves, oil separators, service ports and refrigerant regulator.

2. Refrigerant: Factory charged.

3. Variable Flow Control: Modulate compressor capacity automatically to maintain constant suction and condensing pressure while varying refrigerant flow to suit heating/cooling loads.

4. Capable of being installed with wiring and piping to the left, right, rear or bottom.

5. Capable of heating operation at low end of operating range as specified, without additional low ambient controls or auxiliary heat source; during heating operation, reverse cycle (cooling mode) oil return or defrost is not permitted due to potential reduction in space temperature.

6. Power Failure Mode: Automatically restart operation after power failure without loss of programmed settings.

7. Provide refrigerant auto-charging and refrigerant charge check functions.

8. Safety Devices: High pressure sensor and switch, low pressure sensor/switch, control circuit fuses, crankcase heaters, fusible plug, overload relay, inverter overload protector, thermal protectors for compressor and fan motors, over current protection for the inverter and anti-cycling timers.

9. Provide refrigerant sub-cooling to ensure the liquid refrigerant does not flash when supplying indoor units.

10. Oil Recovery Cycle: Automatic, occurring 2 hours after start of operation and then every 8 hours of operation; maintain continuous heating during oil return operation.

11. Controls: Provide contacts for electrical demand shedding.

B. Unit Cabinet: Weatherproof and corrosion resistant; rust-proofed mild steel panels coated with baked enamel finish.

1. Designed to allow side-by-side installation with minimum spacing

C. Fans: One or more direct-drive propeller type, vertical discharge, with multiple speed operation via DC (Digitally Commutated) inverter.

1. External Static Pressure: Factory set at .12" WG, minimum. Capable of up to .32" WG External Static Pressure

2. Fan Airflow: As indicated for specific equipment.

3. Fan Motors: Factory installed; permanently lubricated bearings; inherent protection; fan guard; output as indicated for specific equipment.

D. Condenser Coils: Copper tubes expanded into aluminum fins to form a mechanical bond; waffled louver fin and rifled bore tube design to ensure high efficiency performance.

E. Compressors: Scroll type, hermetically sealed, variable speed inverter-driven suit total capacity; minimum of one variable speed, 2 compressor units shall have dual variable speed scroll compressors, Unit shall modulate from 10 percent to 100 percent of total capacity.

1. Variable Speed Control: Capable of changing the speed to follow the variations in total cooling and heating load as determined by the suction gas pressure; high/low pressure calculated by samplings of evaporators and condenser temperatures every 20 seconds, with compressor capacity adjusted to eliminate deviation from target value by changing inverter frequency or on/off setting of fixed speed compressors.

2. Multiple Condenser Modules: Balance total operation hours of compressors by means of duty cycling function, providing for sequential starting of each module at each start/stop cycle, completion of oil return and completion of defrost, or every 8 hours.

3. Failure Mode: In the event of compressor failure, operate remaining compressor(s) at proportionally reduced capacity; provide microprocessor and associated controls specifically designed to address this condition.

4. Inverter Driven Compressors: PWM inverter driven, highly efficiency reluctance DC (Digitally Commutated), hermetically sealed scroll with maximum speed of 7,980 rpm.

5. Rotors: Incorporating neodymium magnets for higher torque and efficiency; at complete stop of compressor, position rotor into optimum position for low torque start.

6. Provide each compressor with crankcase heater, high pressure safety switch and internal thermal overload protector.

7. Provide oil separators and intelligent oil management system.

8. Provide spring mounted vibration isolators.

9. Hail Guards, Boxed Metal type painted to match the unit, wire mesh is unacceptable.

4.02 INDOOR/EVAPORATOR UNITS

A. All Indoor/Evaporating Units: Factory assembled and tested DX fan-coil units, with electronic proportional expansion valve, control circuit board, factory wiring and piping, self-diagnostics, auto-restart function, 3 minute fused time delay and test run switch.

1. Refrigerant: Refrigerant circuit factory-charged with dehydrated air, for field charging.

2. Temperature Control Mechanism: Return air thermistor and computerized Proportional-Integral-Derivative (PID) control of superheat.

3. Coils: Direct expansion type constructed from copper tubes expanded into aluminum fins to form a mechanical bond; waffled louver fin and high heat exchange, rifled ore tube design; factory tested.

a. Provide thermistor on liquid and gas lines.

4. Fans: Direct-drive with statically and dynamically balanced impellers; high and low speeds unless otherwise indicated; motor thermally protected.

5. Return Air Filter: Washable long-life net filter with mildew-proof resin, unless otherwise indicated.

6. Condensate Drainage: Built-in condensate drain pan with PVC drain connection.

a. Units With Built-In Condensate Pumps: Provide condensate safety shut-off and alarm

b. Units Without Built-In Condensate Pumps: Provide manufacturer recommended external condensate pump, minimum 10ft of head. See Drawings for required flowrate. Provide with built-in condensate float switch and wiring connections for condensate safety shut-off and alarm.

7. Cabinet Insulation: Sound absorbing foamed polystyrene and polyethylene insulation.

B. Recessed Ceiling Units – 3’x3’ Four-way airflow cassette with central return air grille, for installation in a fixed ceiling.

1. Face Size: 33” square, nominal.

2. Cabinet Height: Maximum of 10” above face of ceiling.

3. Exposed Housing: White, impact resistant, with washable decoration panel.

4. Supply Airflow Adjustment:

   a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.

   b. Field-modifiable to 3-way or 2-way airflow.

   c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.

5. Return Air Filter: Manufacturer's standard.

6. Minimum Capacity: As indicated on the drawings.

7. Fan: Direct-drive turbo type

8. Built in Occupancy Sensor

9. Condensate Pump: Built-in, with lift of 21 inches, minimum.

10. Provide side-mounted supply air branch duct connection.

C. Recessed Ceiling Units – 2'x2' Four-way airflow cassette with central return air grille, for installation in standard 24"x24" lay-in ceiling grid.

1. Cabinet Height: Maximum of 12" above face of ceiling.

2. Exposed Housing: White, impact resistant, with washable decoration panel.

3. Supply Airflow Adjustment:

   a. Via motorized louvers which can be horizontally and vertically adjusted from 0 to 90 degrees.

   b. Field-modifiable to 3-way or 2-way airflow.

   c. Three auto-swing positions, including standard, draft prevention and ceiling stain prevention.

4. Return Air Filter: Manufacturer's standard.

5. Minimum Capacity: As indicated on the drawings.

6. Fan: Direct-drive turbo type

7. Condensate Pump: Built-in, with lift of 21 inches, minimum.

8. Provide side-mounted supply air branch duct connection.

D. Concealed-In-Ceiling Units: Ducted horizontal discharge and return; galvanized steel cabinet.

1. Return Air Filter: Manufacturer's standard.

2. Motor shall be ECM

3. Provide external static pressure switch, adjustable for high efficiency filter operation.

4. Condensate Pump: Built-in, with lift of 9", minimum.

   a. For units without built-in pump capability, provide manufacturer recommended external pump with float switch and wiring for condensate safety shut-off and alarm. See drawings for required flow rate (minimum 10ft of head).

5. Switch box accessible from side or bottom.

6. Manufacture shall provide 2" Filter Rack with both side and bottom access doors

E. Wall Surface-Mounted Units: Finished with white casing, with removable front grille; foamed polystyrene and polyethylene sound insulation; wall mounting plate; polystyrene condensate drain pan.

1. Airflow Control: Auto-swing louver that closes automatically when unit stops; five (5) steps of discharge angle, set using remote controller; upon restart, discharge angle defaulting to same angle as previous operation.

2. Condensate Drain Connection: Back, with piping concealed in wall.

3. Fan: Direct-drive cross-flow type.

PART 5 – VRF HVAC EQUIPMENT ALTERNATE (GENERAL INFORMATION)

5.01 The alternate equipment supplier shall provide to the Mechanical Engineer 15 Days prior to bid day a complete equipment data package.

5.02 The submitted documents shall be complete system designs and show no less information than the HVAC equipment/controls contract bid documents.

*Additional Items for submission that is required in addition to the above:

1. References of 5 VRF Applications within 100 mile radius of this job site, must include type of product on project, along contact phone numbers.

2. Comply/ No-Comply statement to address each item in specification.

3. For comparison purposes all equipment files are to be provided to engineer as BIM Object files in Revit format.

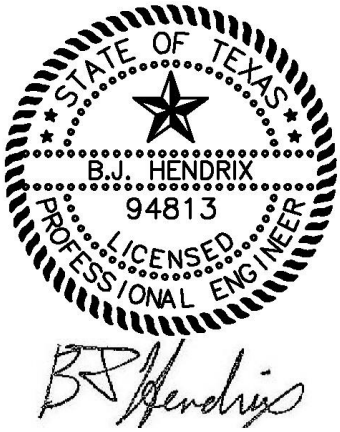
4. AHRI data sheets shall be provided to verify certification.

5.03 Submitted information shall include de-rates for line lengths, specified ambient conditions, connection ratio and any other job specific conditions. Standard catalog data is not acceptable.

END OF SECTION

DIVISION 26 & 28
BRADY ISD – 2018 BOND
ELECTRICAL SPECIFICATIONS

CONTENTS:



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SECTION 26 05 00 - GENERAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

Unless otherwise specified, provide all labor, equipment, supplies, materials, superintendence and testing necessary for the installation of complete electrical systems as required by these specifications and as shown on the Drawings, subject to the terms and conditions of the contract. Complete such details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical systems described on the Drawings. Include empty conduits as required for all special systems and power for condensate pumps and HVAC control panels as required by the Mechanical Contractor. Field coordinate exact locations.

A. Submit a bid on the basis of a complete installation, including all labor, material, cartage, insurance, permits, associated fees and taxes.

B. Include temporary electrical power and lighting that will be required for the interior of the buildings. Provide lighting to satisfy OSHA requirements and the NEC.

C. All Agreement Forms, General Conditions, Supplementary Conditions, and Division 1 of the specifications shall apply to the work specified in Division 26-28.

D. Additional Site Visit Costs: The Contractor shall be charged with any cost resulting from uncompleted items that require additional site trips by the Architect/Engineer.

E. No attempt has been made to show complete design details of building construction on the Electrical plans. Refer to Architectural, Structural and Mechanical plans for additional details which will affect electrical work. No extra cost will be allowed for offsets in conduit and wiring to avoid other work or when minor changes are necessary to facilitate installation or maintenance.

F. Electrical Contractor is to provide all parts and labor to make final connections to all equipment shown in contract documents. Power may be shown in general location, it is expected that Electrical Contractor coordinate final locations for rough-in and connection requirements with exact equipment being installed. These items include but not limited to book security, exhaust fans, kilns, hand dryers, sensor operating plumbing devices, overhead doors, powered curtain, fire alarm door hold opens, etc.

G. NO TOXIC NOR HAZARDOUS MATERIALS, INCLUDING BUT NOT LIMITED TO PRODUCTS OR MATERIALS CONTAINING ASBESTOS, PCB AND LEAD SHALL BE PROVIDED OR INSTALLED.

H. REMODEL WORK: COORDINATE ALL CONNECTIONS OF NEW EQUIPMENT WITH EXISTING SERVICES. THE CONTRACTOR SHALL FURNISH AND INSTALL ALL EQUIPMENT, MATERIALS AND INCIDENTAL ITEMS REQUIRED TO MAKE SYSTEM COMPLETE AND OPERABLE.

I. AN EXTRA COPY OF ALL FIELD REPORTS SHALL BE KEPT IN A SEPARATE NOTEBOOK. CONTRACTOR TO SET UP IN THE CONSTRUCTION MANAGER'S TRAILER. THESE REPORTS SHALL BE USED FOR CONTRACTOR TO CHECK THAT EACH INDIVIDUAL ITEM NOTED HAS BEEN COMPLETED. ALSO KEEP LOG OF WHERE EXTRA RECEPTACLES AND OUTLET BOXES CALLED OUT IN 26 27 26, 3.01 AND 26 05 80, 2.01. ARE INSTALLED.

J. Electrical Contractor shall use Fire Alarm Contractor's Shop Drawings and Rough-In details on drawings for rough-in of all fire alarm devices. Any devices not roughed-in according to Fire Alarm Shop Drawings and drawing details shall be relocated at no cost to Owner.

K. Sensor Operated Plumbing Devices: Plumbing Contractor to provide transformers from manufacturer. Electrical Contractor to provide all other electrical materials and labor to provide complete and workable device. This includes but is not limited to receptacles for plug in transformers, line voltage wire/conduit for direct connect low voltage transformers, all low voltage plenum rated 16 gauge wire.

L. **Cad Drawings:**
Architectural Background Files – **Architectural Files are background files, MEP drawings are not background files.** To insure the most current Architectural files are used for shop drawings backgrounds, they must be obtained from the architect and cannot be given from the engineer. Reference Architect for cost of Architectural Files.

MEP Drawings – These drawings cannot be used for shop drawings, as they are diagrammatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades. If MEP floorplan files are requested, they may be obtained with a signed confidentiality release form, only as outlined below. These files may be used in conjunction with this project only. There are no guarantees of compatibility or accuracy; all technical support will be billed hourly at current Engineer's Rates. Engineer does not charge for actual file, but does charge for time required to prepare the files in format as requested by the Contractor. Fees will be based on Engineer's current hourly rates. Deposit of $500 must be paid prior to beginning file preparation and balance must be paid prior to release of any files. Total fee based on actual time required by Contractor's request. See submittal and shop drawing section for additional information.

MEP CAD Files that will be released.
- If no Architectural RCP is available for light locations, Lighting Floorplans will be released.
- Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.
- Fire Alarm/Fire Sprinkler/Intercom etc… Contractors must use Architectural Revit Models and CAD files for backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. This must be obtained from Architect. Engineer may not release architectural drawings.

M. The Contractor binds himself, his partners, successors, assigns and legal representatives to the Owner hereto in respect to all covenants, agreements and obligations contained in the Contract Documents. The Contractor shall not assign the Contract, or sublet it as a whole, without the written consent of the Architect/Owner, nor shall the Contractor assign any monies due or to become due to him hereunder, without the previous written consent of the Owner/Architect.

N. The Contractor shall supervise and direct the Work using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, safety, sequences and procedures and for coordinating all portions of the Work under his Contract.

O. The Contractor shall provide, without extra charge, all incidental items required as a part of the Work, even though not particularly specified or indicated, and if he has good reason for objecting to the use of a material, appliance, or type of construction shown or specified, he shall register his objections with the Architect/Engineer, in writing; otherwise, he shall proceed with the work under the stipulation that a satisfactory job is required.

P. Provide a completed Schedule of Values, see Specification Section 26 05 10. Preliminary schedule of values shall be submitted to Architect/Engineer for review.

1.02 SITE INSPECTION

A. Prior to Bidding, the Contractor shall visit and examine the site verifying all existing items and familiarize himself with existing work conditions and understand the conditions which affect performance of the work of this Division before submitting bids for this work. The submission of bids shall be deemed as evidence of such visits and examinations.

B. All bids shall take the existing conditions into consideration and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility. No subsequent allowance for time or money will be allowed for work or change related to failure to examine site conditions.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. All work covered by this section of these specifications shall be accomplished in accordance with the respective drawings, information or instructions to bidders, and general provisions of these specifications. Any supplementary conditions, special conditions, addenda, or directives which may be issued by the Owner's representative, herewith or otherwise, shall be complied with in every respect.

B. Provide electrical connections and service to items described in all other sections of these specifications.

C. The Electrical Contractor shall provide all wiring and connections required to fire/smoke dampers. Coordinate exact locations of dampers with Mechanical Contractor and relay requirements with Fire Alarm Contractor.

D. The Electrical Contractor shall provide all wiring and connections required to backdraft dampers at exhaust fans. Coordinate exact locations of dampers with Mechanical Contractor.

E. Electrical Contractor to provide conduit and junction boxes for all sensors and exterior conduit for controls to mechanical equipment. Conduit for space sensor to extend from junction box to above accessible ceiling. Conduit for exterior equipment to extend from equipment through wall or roof to above an accessible ceiling. Any control wiring in exposed ceiling areas to be in conduit by Controls Contractor for protection. Controls Contractor to coordinate on all conduit requirements. Coordinate locations with Electrical Contractor.

1.04 WORK NOT INCLUDED

A. Certain labor, materials, or equipment may be provided under other sections of these specifications, by utility companies, or by the Owner. When such is the case, the extent, source and description of these items will be as indicated on the Drawings or described in the specifications, but the Contractor is responsible for verifying with all parties involved as to the extent of his requirements of work.

B. Unless otherwise indicated, motors shall be furnished by others, but connected by the Electrical Contractor as indicated on the Drawings.

C. Unless otherwise specified, Mechanical equipment control low voltage wiring (less than 50 VAC) shall be provided and installed by the Mechanical Contractor.

1.05 SPECIFICATION TERMINOLOGY (Definitions)

A. "Provide": Includes all material, installation, labor subcontracts, appurtenances and mark-up required for a complete operable system as shown and specified, set in place, connected and ready to use.

B. "Furnish": Purchase and deliver to job site, material as shown and specified.

C. "Install": Includes all installation, labor subcontracts, appurtenances and mark-up required for complete installation of equipment furnished by others.

D. "Record Drawings": Drawings that reflect the electrical systems as actually constructed by the Contractor including conduit routing.

E. "Accessible" means arranged so that an appropriately dressed maintenance man may approach the area in question with tools and products necessary for the work intended, and may then position himself to properly perform the task to be accomplished, without disassembly or damage to the surrounding installation. All clearances per NEC.

F. Wherever the term "shown on drawings" is used in the specifications, it shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.

G. "Conduit" includes, in addition to conduit, all fittings, hangers and other accessories relative to such conduit system.

H. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, imbedded in construction, crawl spaces, etc.

1.06 DIAGRAMMATIC DRAWINGS:

A. The drawings are in general diagrammatic, and the location of outlets, switches, motors, etc., on the drawings does not necessarily mean that such units shall be placed at that exact spot, as scaled on the drawings, but shall be located to function best. Use the drawings, and these specifications for guidance and secure the Engineer's approval of all changes in location. Coordinate all dimensions for floor boxes with Architect. Contractor shall not scale from drawings.

B. Verify all measurements at the site. No extra compensation will be allowed because of differences between locations shown on the drawings and measurements at the building.

C. The Contractor is to draw electrical rooms and service to scale **(1/4" minimum)** with actual equipment to be used and submit to the Engineer prior to installation. The Contractor must insure that all minimum NEC working clearances are maintained. Coordinate with equipment of other trades.

D. Where lighting fixtures and other electrical items are shown in conflict with structural members and mechanical or other equipment, provide all required supports and wiring to clear the encroachment.

E. The branch circuits and arrangement of home runs have been designed to compensate for voltage drop and other considerations to accomplish maximum economy. Re-circuiting will not be permitted without specific approval. **Circuit numbers may change to achieve balanced loads on panels.**

F. In the event of discrepancy, immediately notify the Engineer. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

G. Drawings and specifications are complimentary each to the other. What is called for by one shall be as binding as if called for by both.

H. Should the drawings disagree in themselves, or with the specifications, the better quality or greater quantity of work or materials shall be used.

I. Outlets and switches obviously placed in a location not suitable to the finished room or area shall be removed and relocated when so directed by the Architect at no cost to the Owner. The Architect shall have the right to make any reasonable change in outlet locations before rough-in without additional cost to the Owner. The contractor shall contact engineer when switches are inadvertently shown on hinge side of door prior to rough-in.

J. Location of light fixtures shall be coordinated with reflected ceiling plans and/or room finish schedules.

1.07 MATERIAL AND EQUIPMENT SUBMITTALS

A. Submittals: Provide submittals for all products and systems described in Division 26-28 and shown on the drawings to demonstrate compliance with the requirements of the project. Furnish equipment submittals in the manner described elsewhere in these specifications.

B. Submit to the Engineer, after the award of the contract or as dictated by project schedule, a type written list of those items of equipment and appurtenances which will be furnished. Include the name or description of the item, name of manufacturer, model or type, catalog number and manufacturer's printed information. The information submitted shall include overall dimensions, weights, voltage rating, phase, wiring diagrams, etc., and nameplate data. Assemble cut sheets into separate submittals as defined in this section or by Specification Section. Submit priority items and long lead time first. Then follow with remaining items. This will allow for faster review and response to accommodate project

schedule. **Any submittal with all sections under one (1) submittal number will be returned and required to be broken into unique separate submittal numbers.** The Engineer's check will be general and does not relieve the Contractor of final responsibility to comply with the Contract Documents in all respects.

C. Submittal review is for general design and arrangement only and does not relieve the Contractor from any of the requirements of the Contract Documents. Submittals will not be checked for quantity, dimension, fit or proper technical design of manufactured equipment. Where deviations of substitute product or system performance have not been specifically noted in the submittal by the Contractor, provision of a complete and satisfactory working installation is the sole responsibility of the Contractor. **Warranties cannot be reduced through the submittal process.**

D. Contractor shall indicate items being used on cut sheets by highlighting or arrowing to actual part number. Submittals may be returned without checking if submittals not appropriately marked.

E. **'Individual submittals' means separate submittals with unique submittal numbers for each specification section. Separate PDFs for each Submittal number.**

F. HARDCOPY SUBMITTAL REQUIREMENT: Hardcopy submittals will not be required by Engineer.

G. PDF SUBMITTAL REQUIREMENT:
For submittal sections listed below as allowed pdfs, the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each specifications section must be a separate pdf file, **one giant pdf for all sections will be rejected**.

PDF FILE: MUST BE NAMED AS FOLLOWS:
JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

EMAIL TITLE/SUBJECT: FOR SUBMITTALS MUST BE AS FOLLOWS:
JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION

Failure to follow these instructions will result in the submittal never reaching the engineer and not being checked. Delays caused by not following these procedures are the sole responsibility of the contractor. Emailed submittals must come from the Architect and must not be emailed directly from the contractor. Do not Carbon Copy the Engineer on Emailed submittals.

H. **Multiple re-reviews required due to Contractor not following instructions, specifications, etc will be billed to Contractor at Engineer's current hourly rates. This shall be paid prior to submittal approval.**

I. Submittals will be returned in order of construction of the project, not necessarily in order submitted. If all sections are submitted under one binder/at one time and transmittal, each section will be returned at the appropriate time for construction phasing. Electrical Gear will not be reviewed until "Mechanical/Electrical Coordination Sheet" has been submitted. Electrical Gear and Light Fixtures may require extended review time**. If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.**

J. DO NOT SUBMIT THE FOLLOWING SECTIONS UNLESS DEVIATING FROM THE SCHEDULES/SPECIFICATIONS. Provide directly to General Contractor/CMR for inclusion into O & M Manuals. If deviating from the specifications, submittal will be required. (Highlight items in each submittal content that are different to allow for proper review.):

1. 26 05 00 – General Provisions
2. 26 05 10 – Schedule of Values
3. 26 05 19 – Wire and Cable
4. 26 05 26 – Grounding and Bonding
5. 26 05 29 – Hangers and Supporting Devices
6. 26 05 33 – Raceways
7. 26 05 34 – Outlet Boxes, Pull Boxes and Junction Boxes
8. 26 05 80 – Empty Raceway Rough-In
9. 26 27 26 – Devices
10. 26 28 10 – Manual Motor Starters
11. 26 28 15 – Safety Disconnect Switch
12. 26 28 16 – Fuses
13. 26 28 20 – Combination Motor Starters
14. 26 28 25 – Contactors

K. **PDF Submittals Allowed** for Product Cut-Sheets are limited to the following items:
Separate PDF file for each Submittal number is required. Follow file format above.

1. 26 24 13 – Main Switchboard
2. 26 24 16 – Branch Circuit Panelboards
3. 26 43 00 – Surge Protective Devices
4. 26 51 00 – Interior Lighting System
5. 26 56 00 – Exterior Lighting System
6. 28 31 00 – Fire Alarm System - (Product Data and Shop Drawings)
7. Electric Rooms (coordinate with mechanical). Also, include other equipment and/or systems on plan.

L. When requested, present samples of all materials proposed for use to the Engineer for his approval.

M. Certify Shop Drawings have been checked for compliance with Contract Documents. Certify that the materials submitted can be delivered and installed according to the construction schedule.

N. Select all other materials, not specifically described on the Drawings or in these specifications but required for a complete and operable facility, and submit to the Engineer for approval.

O. **Substitutions:** ("Substitution Request" form must be submitted)

1. Substitutions must be made and accepted PRIOR to Bid.
2. Unless otherwise indicated, base bid on the equipment shown on the Drawings and hereinafter specified.

3. Request for approval to substitute materials, methods, or processes shall be made to Architect and if found acceptable, will be confirmed by an addendum to the Construction Documents. Where proposed substitutions are not incorporated into the Construction Documents by addendum **PRIOR** to time of the General Contract bid opening, all bids shall be held to have been made on the basis of the materials, methods and processes required by the Construction Documents.

4. All substitutions shall be of equal or better quality to the equipment specified.

5. Acceptance of the substitution by the Engineer does not relieve the Contractor of responsibility for proper operation of the systems, compliance with specifications, necessary changes due to dimensional differences or space requirements, and completion of work on schedule.

6. It is not the intent of the Specifications to limit materials to the product of any particular manufacturer. Where definite materials, equipment and/or fixtures have been specified by name, manufacturer or catalog number, it has been done so as to set a definite standard and a reference for comparison as to quality, application, physical conformity and other characteristics unless no substitutions are noted.

7. **Submit fully completed "Substitution Request" form located at end of this section. If this form is not submitted, all substitution request will be automatically rejected.**

8. **For substitutions that require substantial review by engineer to ensure equality, the contractor requesting substitutions shall reimburse the engineer at current hourly rates for all review time. This shall be paid prior to submittal approval. This applies to all equipment not previously approved on construction documents.**

    a. Light Fixtures Packages

    b. Alternate Transformers

    c. Alternate Surge Protective Devices

    d. Alternate Equipment/Gear Packages

    e. Contractor Cost Savings Packages Requiring Substantial Review Time

1.08 SHOP DRAWINGS REQUIRED

A. Prepare and submit working construction drawings as requested, specified, and otherwise necessary to demonstrate proper planning for installation and arrangement of all work. Layout drawings to scale and show dimensions where accuracy of location is necessary for coordination or communication purposes. Show work of all trades, including Architectural, Structural, Mechanical, and Electrical items which may be pertinent to proper and accurate coordination.

B. Architectural drawings must be used for backgrounds in preparation of shop drawings and shall be obtained from the Architect. Confirm requirements and stipulations for obtaining floor plan backgrounds with Architect and with other sections of specification. Engineer's drawings and CAD files **may not** be used for Shop Drawings. Reference 1.01-L.

C. Reference other specification for additional requirements.

    1. Fire Alarm

    2. PA System

    3. Electrical Rooms

1.09 RECORD DRAWINGS

A. Reference requirements stated elsewhere in the specifications.

B. THE CONTRACTOR SHALL TAPE ALL ADDENDAS ISSUED DURING BIDDING TO HIS CONSTRUCTION AND RECORD DRAWING SET PRIOR TO COMMENCING CONSTRUCTION. PAY REQUESTS WILL NOT BE PROCESSED UNTIL THIS REQUIREMENT IS MET.

C. In addition to other requirements, a master Record Drawing print set (separate from field sets) shall be kept in the site construction office as the work progresses. Show routing and location of items cast in concrete or buried underground. Work located in spaces with access, or above suspended ceilings, is not considered permanently concealed. Show complete routing and sizing of any significant revisions to the systems shown. Indicate locations of all existing active and inactive conduit uncovered during construction**. Keep marked up set at site for review at site meetings**.

D. **Contractor to indicate conduit routing locations for all major runs and branch circuits under slab along with major junction locations.**

E. The Contractor shall be responsible for updating all items, including but not limited to floor plan changes, system changes, addendums, change orders, etc. on the prints to "As-Built" conditions. At the completion of the job the marked up As-Built Drawings shall be submitted to the Architect for final review and comment. These corrected prints together with all the revisions, additions and deletions of work, shall form the basis for preparing a set of record drawings.

F. Using the "Record Drawing Set", the Contractor shall print two (2) complete sets of prints one for submission to the Owner and one rolled in a 4" PVC pipe in main electric room mounted to wall and labeled. Tape all edges. The contactor shall provide pdf copies/scans for owner record purposes. Remove Engineer's seal from record drawings.

G. The Contractor shall bear all the costs of producing the "Record Drawing Set".

H. Electrical riser diagrams shall be laminated and mounted in the main electrical room or as directed by the Engineer.

1.10 CODES, REGULATIONS AND ORDINANCES

A. Comply with the requirements of the National Electrical Code, National Electrical Safety Code, Occupational Safety and Health Act (OSHA) and all other applicable Federal, State and local codes and ordinances. All codes and standards shall be per the latest adopted edition with all supplements and official interpretations included. Provide disconnecting means for all equipment per NEC. The Drawings and specifications take precedence when they are more stringent than codes, standards, ordinances, and statutes take precedence when they are more stringent or conflict with the Drawings and specifications.

B. Should the Contractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances and Industry Standards, he shall bear all costs arising in correcting the deficiencies, as approved by the Architect.

C. All work shall also satisfy applicable local codes, ordinances, and regulations of the governing bodies, and all authorities having jurisdiction over the work. Where alterations to, or deviations from, the drawings and specifications are required by the authority having jurisdiction, report the same in writing to the Owner's representative and secure his approval before proceeding.

1.11 DELIVERY AND STORAGE OF EQUIPMENT AND MATERIAL

A. Investigate each space in the building through which equipment must pass to reach its final location. If necessary, the manufacturer shall be required to ship his material in sections sized to permit passing through such restricted areas in the building.

B. Retain all portable and detachable parts or portions of installation such as fuses, key locks, adapters, blocking clips, and inserts until final completion of work. Deliver parts to the Owner or his authorized representative and attach an itemized receipt to obtain request for final payment.

C. Product Handling:

1. Use all means necessary to protect the work and materials of this section before, during, and after installation and to protect the work and materials of all other trades.

2. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

3. Store and protect materials and equipment in accordance with the manufacturer's recommendations.

4. Provide suitable box or crate electrical equipment and cover with waterproof covers to protect against dirt, moisture or accidental damage during shipment or outdoors at the job site.

5. Store all conduits on skids.

1.12 SERVICEABILITY OF PRODUCTS

A. Furnish all products to provide the proper orientation of serviceable components to access space provided.

B. Coordinate installation of piping, ductwork, equipment, conduits, junction boxes, panels and other products to allow proper service of all items requiring periodic maintenance or replacement.

C. Replace or relocate all products incorrectly ordered or installed to provide proper serviceability.

1.13 ACCESSIBILITY OF PRODUCTS

A. Arrange all work to provide permanent, convenient and safe access to all serviceable and/or operable products. Layout work to optimize net usable access space within confines of space available. Advise Architect, in a timely manner, of areas where proper access cannot be maintained. Furnish layout drawings to verify this claim, if requested.

B. Provide access doors in ceilings, walls, floors, etc. for access to automatic devices and all serviceable or operable equipment in concealed spaces. Location of panels shall be submitted for approval in sufficient time to be installed in the normal course of work.

1.14 UTILITY COSTS

A. Provide complete utility service connections. The locations and elevations of the various utilities included within the scope of this work have been obtained from city and/or other substantially reliable sources as a general guide only, without guarantee as to accuracy. Verify the locations, elevations, and availability of all utilities and services required, and be adequately informed as to their relation to the work.

B. Include all service charges required by the electric utility or telephone/data/cable utility. Reference General Conditions for further information. Keep all utility company charges as a separate line item in bid. If cost is not available from utility company, indicate utility contact person, telephone number and **date of contact**.

1.15 CLEAN-UP

A. Remove debris and waste materials from within the construction areas and transport off-site, daily.

B. Keep the construction area clean, free from hazard, and orderly arranged.

C. Pay all costs of waste removal and disposal. Reference General Conditions for further information.

D. Dispose of waste materials in accordance with all regulations which govern.

E. Take all precautions to protect persons who enter the construction area from hazardous conditions, hazardous waste, toxic waste, or other unsafe conditions.

F. Upon completion of construction, remove all debris, waste materials, unused materials, temporary constructions, vehicles, tools, fencing, etc. to Owner's satisfaction.

G. All equipment and materials shall be protected from physical moisture absorption, metallic corrosion and weather damage from time of delivery to completion of project. Replace any damaged materials.

PART 2 - PRODUCTS

2.01 EQUIPMENT AND MATERIALS

A. Unless otherwise indicated, provide only new equipment and materials.

B. On all major equipment components, provide manufacturer's name, address, model number, and serial number permanently attached in a conspicuous location.

C. All materials furnished under these specifications shall be the standard product of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest approved standard design.

D. Guarantees:

1. The Contractor and Manufacturers shall provide a ONE (1) YEAR guarantee for all work under the Electrical Trade. However, such guarantees shall be in addition to and not in lieu of all other liabilities which the manufacturer and the Contractor may have by law or by other provisions of the Contract Documents. In any case, such guarantees and warranties shall commence when the Owner accepts the mechanical/electrical system, as determined by the Architect and shall remain in effect for a period of ONE (1) YEAR thereafter.

2. All materials, items of equipment, all lighting, and workmanship furnished under each section shall carry a ONE (1) YEAR warranty against all defects in material and workmanship. Any fault under any contract, due to defective or improper material, equipment, workmanship or design which may develop, shall be made good, forthwith, by and at the expense of the Contractor for the work under his Contract, including all other damage done to areas, materials and other systems resulting from this failure.

3. The Contractor shall guarantee that all elements of the system, which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.

4. Upon receipt of notice from the Owner of failure of any part of any systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Contractor for his respective work, as applicable.

5. Furnish, before the final payment is made, a written guarantee covering the above requirements.

6. Reference other guarantee information elsewhere in these specifications.

E. All materials exposed within a plenum shall be noncombustible or shall have a flame spread index of not more than 25, and a smoke developed index of not more than 50, when tested in accordance with ASTM E 84.

2.02 STANDARDS

A. Where the Underwriters' Laboratories (UL) have established standards and issued labels for a particular group, class or type of material, apparatus, appliance or device, provide the UL label on all such items in that category incorporated into the work.

B. Where such items are not covered by UL standards, they shall meet or exceed the requirements of the current National Electrical Code (NEC), or if not covered there, by the applicable, published, recognized standard of the American National Standards Institute (ANSI), or of the industry and of the related engineering society. Example: National Electrical Manufacturers Association (NEMA) and Institute of Electrical and Electronics Engineers (IEEE).

C. Contractor is to follow the most current version adopted for all codes and standards.

PART 3 - EXECUTION

3.01 CUTTING AND PATCHING

A. Carefully lay out all work in advance so as to minimize cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, etc. Perform all cutting, channeling, drilling, etc., as required for the proper support, concealment, installation, or anchorage of raceways, outlets, or electrical equipment in a careful manner. Any damage to the building, structure, piping, ducts, equipment, or defaced finish, tile, plaster, woodwork, or metal work shall be repaired by skilled mechanics of the trades involved at the Contractor's expense and to the satisfaction of the Engineer. All cutting, channeling, chasing, or drilling of unfinished masonry, tile, etc., or cutting, drilling, anchoring to or welding of structural members shall be performed in a manner having the Engineer's prior approval. All openings made in fire rated or smoke rated walls, floors, and ceilings shall be patched and made tight in a manner to conform to the fire rating or smoke rating for the enclosure.

B. Where conduits pass through exterior walls, thoroughly caulk with sealant the annular space around the conduit to provide a watertight closure at the interior wall cavity and exterior wall surface. Provide ¼" maximum annular space around the conduit. Provide and install all counterflashing of all conduit, pipe and supports which pierces roofs and other weather barrier surfaces. Verify detail with Architect before installation. All work shall be performed in a workmanlike manner to assure weatherproof installation. Any leaks developed shall be repaired at his expense, to Architect's satisfaction. All waterproofing, flashing and counterflashing shall be compatible with roofing system so as not to void any roof warranties. Confirm installation with Architect and Roofing Contractor.

3.02 SEALING AND FIREPROOFING

A. **SEALING OF PENETRATIONS THROUGH RATED WALLS, FLOORS, CEILING AND ROOF ASSEMBLIES SHALL BE INSTALLED PER UL "FIRE RESISTANCE DIRECTORY." UL SYSTEM NUMBERS INDICATED ARE FOR A PARTICULAR LISTED INSTALLATION AND ARE FOR GENERAL INFORMATION AND INTENT. OTHER LISTED UL SYSTEM DESIGNS MAY BE USED. IN ALL CASES, SUBMIT MATERIALS, UL SYSTEM DESIGN NUMBERS AND UL DETAILS TO BE USED THROUGHOUT THE PROJECT AND IDENTIFY WHICH DETAIL IS TO BE USED FOR EACH SPECIFIC CONDITION. POST REVIEWED DETAIL AT JOB SITE FOR REFERENCE.**

1. Only materials tested in the specific UL System No. may be used.

a. Caulk Manufacturer:

1) 3M Type CP-25 W/B + for all assemblies requiring 3M caulk.

2) For WL3045 and WL3046 use Hilti FS611A sealant.

b. Steel Sleeve (stud wall) (UL System No. WL1003): Cylindrical sleeve shall be fabricated from minimum 0.019" thick (no. 28 gauge) galvanized sheet steel and having a minimum two inch (2") lap along the longitudinal seam. Length of steel sleeve to be equal to thickness of wall plus one inch (1") such that, when installed, the ends of the sleeve will project approximately 1/2" beyond the surface of the wall on both sides of the wall assembly. The diameter of the openings cut on each side of the wall assembly (concentric with conduit) to be 2 to 2-1/2" larger than the outside diameter of conduit such that, when the steel sleeve is installed, a 1 to 1-1/4" annular space will be present between the steel sleeve and the conduit around the entire circumference of the conduit. Install sleeve by coiling the sheet steel to a diameter smaller than the through opening, inserting the coil through the openings and releasing the coil to let it uncoil against the circular cutouts in the gypsum wallboard layers.

c. Optional Steel Sleeve (concrete or block wall): Except for single insulated cables, provide sleeve cast in floor/wall or mortared into CMU wall; Schedule 40 or heavier, length to extend a maximum one inch (1") from top surface of floor or a maximum of one inch (1") from both sides of wall.

d. Forming Material: Minimum one inch (1") thickness mineral-wool batt insulation material. Tightly pack into sleeve with minimum 1/2" recess on ends. Manufacturer: Thermafiber Safing Insulation.

2. Firestop system shall be installed at top surface of floor and symmetrically on both sides of wall assemblies and one (1) side of floor.

3. Alternate floor penetration system (with firestop mortar): UL System No. CAJ1032.

4. Wires and Cables:

a. For gypsum frame wall, single cable: Fireproof per UL System No. WL3001. Opening for cables to be hole-sawed through gypsum wall board layers. Diameter of opening to be 3/8" to 5/8" larger than outside diameter of cable. Cable to be rigidly supported on both sides of wall assembly. Caulk to fill annular space throughout thickness of gypsum wall board layers and apply 1/4" bead of caulk to perimeter of cable at its egress from wall (both sides).

b. For gypsum frame wall, multiple cables: Use UL system No. WL3021, WL3045, WL3046 or equivalent to maintain rating of wall.

c. For concrete walls/floors or CMU walls, single or multiple cables: Fireproof per UL System No. CAJ3030. Install sleeve in assembly flush with both sides. Cables to be a minimum of ten percent (10%) and a maximum of thirty-three percent (33%) of cross-sectional area of opening. Recess minimum one inch (1") thickness of mineral wool material into opening around cables. Caulk openings around cable to minimum depth of one inch (1"). Optional sleeve may be used per UL detail requirements.

5. Reference Architectural for the exact location of all rated walls, floors, ceilings and ceiling/roof assemblies.

6. Materials used in firestop systems shall be installed in accordance with the manufacturer's written instructions (shall be posted at job site, in General Contractors trailer), provided with materials for specific UL System No.

7. Manufacturers: 3M, Metacaulk, Hilti, BioFireshield or equal.

B. In non-rated walls identified for sound insulation, provide 1/2" space between conduit and sleeve packed with multiple layers of forming material. Allow 5/8" minimum space on each side and caulk with acoustical sealant.

C. **Final condition to prevent passage of fire, smoke, noxious gas and water.**

D. For non-rated electrical/mechanical rooms: Seal all conduit passing through room walls, floors and ceilings with 3M caulk, Type CP-25 WB+.

3.03 WORKMANSHIP AND COMPLETION OF INSTALLATION

A. For the actual fabrication, installation and testing, use only thoroughly trained and experienced workmen completely familiar with the items required and with the manufacturer's recommended methods of installation. In acceptance or rejection of the installed work, no allowance will be made for lack of skill on the part of workmen.

B. Install all specialties as detailed on plans. Where details or specific installation specifications are not included herein, follow approved manufacturer's recommendations.

C. Install complete, thoroughly check, correctly adjust, clean, and leave ready for operation all equipment and material connected with this project.

D. Ballasts, contactors, starters, transformers and like equipment which are found to be noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced.

E. Electrical service stub locations, sizes and quantities for equipment are approximate only. The Contractor must verify all service locations, sizes and quantities with the equipment supplier before rough-in.

F. The Electrical Contractor shall make all final connections to all electrical equipment furnished and set in place by others, including millwork with outlets. The Electrical Contractor shall provide and install all disconnect switches as required.

G. The Electrical Contractor shall provide/install all circuit breakers, power wiring, conduit systems and final connections required for operation of heating cable systems.

H. Provide and install all adjustable mounting brackets, steel bar hangers, T-bar mounting clips, support channels and universal support bridges as required for installation of recessed light fixtures, speakers, alarm devices and other ceiling mounted devices. Ceiling tile shall not be used to support ceiling mounted devices in lay-in ceilings.

I. Provide wood trim for any semi-recessed panels installed. Verify finishes with the Owner/Architect.

J. Provide Hoffman enclosure (#A-244208WFLP) wall mounted at location shown on plans. Provided in enclosure shall be spare fuses, three (3) of each amperage used in project up to 100 amp size and spare smoke detectors (see Section 28 31 00.)

K. Equipment and materials shall be listed by an organization that evaluates products and states that the equipment or material, either meets appropriate designated standards or has been tested and found suitable for a specified purpose or shall be labeled by the manufacturer to indicate compliance with appropriate standards or performance in the specified manner to be used.

1. Listed or labeled equipment and materials shall be applied, installed, connected, erected, used, cleaned, adjusted, and conditioned in accordance with any instructions included in the listing or labeling.

L. The installation shall be performed by licensed, competent workmen to provide a thorough and complete installation.

M. All work shall be accomplished in conjunction with other trades in a manner which will allow each trade adequate time at the proper stage of construction to fulfill his work.

N. Exact locations shall be determined by reference to the general plans and measurements at the building and shall be subject to reasonable change by the Owner's representative without additional cost.

O. Prior to and during construction, provide adequate storage facilities and properly protect items subject to any damage. Failure to comply with this provision will be sufficient cause for the rejection of the particular apparatus involved.

P. At completion, the installation shall be thoroughly cleaned. All tools, equipment, obstructions, temporary power, temporary lighting and debris shall be removed from the premises.

3.04 BALANCING SYSTEM

A. Balance the electrical system between the respective phases of the system. Balance individual circuits in each panel of the system. Where phase assignments or circuit numbers are indicated on the drawing, do not deviate without the Engineer's approval. All deviations shall be noted on panelboard submittals and on Record Drawings and schedules

3.05 COOPERATION WITH OTHER CONTRACTORS

A. Cooperate with other Contractors so that the installation of the electrical materials and equipment may be properly coordinated. Where a conflict occurs with piping, duct work, etc., it shall be resolved as directed by the Engineer.

B. Interferences between conduit and other trades shall be handled by giving precedence to pipe lines requiring grade for proper operation. Where space requirements conflict, the following order of precedence shall generally be observed:

1. Building Lines
2. Structural Members
3. Drainage Waste and Vent Piping
4. Refrigerant Piping
5. Ductwork
6. Water and Gas Piping
7. Electrical Conduit
8. Fire Protection Piping

3.06 COORDINATION OF WORK

A. Each Contractor shall compare his drawings and specifications with those of other Trades and report any discrepancies between them to the Architect and obtain from the Architect written instructions to make the necessary changes in any of the affected work. All work shall be installed in cooperation with other Trades installing inter-related work. Before installation, all Trades shall make proper provisions to avoid interferences in a manner approved by the Architect.

B. Locations of conduit and equipment shall be adjusted to accommodate the work with interferences anticipated and encountered. Exact routing and location of systems shall be determined prior to fabrication or installation.

C. Offsets and changes of direction in all conduit systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings.

D. Where discrepancies in scope of work as to which Trade provides items such as starters, disconnects, flow switches and the like exist, such conflicts shall be reported to the Architect prior to signing of the Contract. If such action is not taken, the various Trades shall furnish such items as part of their work for complete and operable systems.

E. Verify voltage, phases, termination points, termination requirements and required disconnects for all equipment provided as part of this contract or equipment furnished by Owner prior to rough-in. Report any discrepancies to Architect/Engineer.

F. The Contractors are to avoid routing conduit through fire rated assemblies where practical. Each trade is responsible for proper coordination of required sleeves or block-outs with rated assembly installers. Each trade is responsible for providing sleeves, as required, for his work. Each trade shall verify acceptable tolerances around penetrating item in fire assembly before beginning fire sealing.

G. The Electrical Subcontractor shall verify with HVAC, Plumbing and Fire Protection Subcontractors the required electrical characteristics for all motors and equipment before ordering and submitting of electrical gear. Verify actual connection points prior to installation and roughing-in. Mechanical and Electrical Contractor are responsible for coordination of electrical requirements and final fuse sizes of all A/C equipment. When Mechanical Contractor substitutes equipment that requires additions or upgrades to electrical system, he shall bear all costs arising from such substitutions. Reference "Mechanical/Electrical Coordination Sheet" in specifications.

3.07 SAFETY PRECAUTIONS AND PROGRAMS

A. It shall be the duty and responsibility of the Contractor and all of its subcontractors to be familiar and comply with all requirements of Public Law 91-696, 29 U.S.C. Secs. 651 et. seq., the Occupational Safety and Health Act of 1970, (OSHA) and all amendments thereto, and to enforce and comply with all of the provisions of this Act. IN ADDITION, ON PROJECTS IN WHICH TRENCH EXCAVATION WILL EXCEED A DEPTH OF FIVE FEET, THE CONTRACTOR AND ALL OF ITS SUBCONTRACTORS SHALL COMPLY WITH ALL REQUIREMENTS OF 29 C.F.R. SECS. 1926.652 AND 1926.653, OSHA SAFETY AND HEALTH STANDARDS.

3.08 OPERATING AND MAINTENANCE MANUALS

A. Provide one (1) Operation and Maintenance manual for training of Owner's personnel in operation and maintenance of systems and related equipment in the manner described elsewhere in these specifications. In addition, organize manuals and include data and narrative as noted below (bind each manual in a hard-backed loose-leaf binder. Use 8-1/2" x 11" white paper). Provide PDF copy of O&M for owner records

B. Operating Sequence and Procedures:

1. Contents: In each chapter, describe the procedures necessary for personnel to operate the system and equipment covered in that chapter.

2. Typewritten Operating Procedures: Write procedures for start-up, operation and shutdown.

a. Start-up: Give complete step-by-step instructions for energizing equipment, making initial setting and adjustments whenever applicable.

3. Shutdown Procedures: Include instructions for stopping and securing the equipment after operation. If a particular sequence is required, give step-by-step instructions in that order.

C. Maintenance Instructions:

1. Provide a schedule of preventive maintenance for each product. Recommend frequency of performance for each preventive maintenance task: i.e., cleaning, inspection, etc.

D. Manufacturer's Brochures: Include manufacturers' descriptive literature covering all appurtenances used in each system, together with illustrations, exploded views and renewal parts lists. Provide the nearest manufacturer's representatives name, address and phone number.

E. Shop Drawings: Provide two copies of all corrected, approved submittals and shop drawings covering equipment for the project either with the manufacturer's brochures or properly identified in a separate subsection.

F. Spare Parts Lists: Include a list of all equipment furnished for the project, with a tabulation of descriptive data of all the spare parts proposed for each type of equipment or systems. Properly identify each part by part number and manufacturer.

3.09 IDENTIFICATION

A. Equip the following items with nameplates:

1. Motor Starters

2. Main Switchboard and Overcurrent Devices and Spares

3. Panelboards and Branch Circuits

4. Safety Disconnect Switches

5. Contactors

6. Control/Power Equipment in Separate Enclosures Including Relays

7. Bypass Switches and Transfer Switches

8. Emergency Generator Sets

9. UPS System and Battery Racks

10. Motor Control Centers

11. Transformers

B. No dymo (stick on indented plastic) type label will be permitted.

C. Identify equipment listed above. COORDINATE EQUIPMENT NUMBERS WITH MECHANICAL AND/OR KITCHEN PLANS. Each piece of equipment shall be numbered consistently throughout.

D. Fabricate nameplates as follows:

1. Provide three (3) ply, 1/16" laminated plastic nameplate material with white core for lettering and black background. All nameplates, for equipment powered from emergency circuits, shall have white core for lettering and red background.

2. Use capital letters.

3. Unless otherwise indicated, provide minimum 3/4" high x 2" long nameplates with 1/4" letters.

4. All labels shall be permanently affixed to the front of all required equipment using two (2) round head self tapping screws. Self-adhesive labels are not acceptable. Align labels with equipment.

E. All junction boxes shall have the panel/circuit number(s) identified on the blank coverplate, handwritten with a permanent black marker. Disconnects, combination motor starter/disconnects and manual motor starter shall have the panel/circuit number(s) identified on the inside of the front cover, hand written with a permanent black marker.

F. Provide engraved coverplates for all switches and control devices which are not otherwise clearly related to the equipment they serve.

G. Label all receptacles and light switches with circuit number using electronic labeler (black on clear). Install label level on front of face plate for receptacles and back side of face plate for light switches.

H. Spray paint J-Boxes red for Fire Alarm System. All other special systems J-Boxes to be painted white.

I. Color code all 600 volt insulated conductors by installing conductors with factory colored insulation for conductors No. 10 AWG and smaller.

J. Install colored tape on all 600 volt conductors No. 8 AWG and larger. Apply tape 6 inches from terminal points. Do not cover factory applied cable identification markings with taping; tape locations may be adjusted slightly to prevent the covering of factory markings. Tape shall be Scotch No. 35 or approved equal, 7-mil thick by 3/4" wide vinyl adhesive tape.

K. Install engraved plastic laminate nameplates as listed below.

EQUIPMENT	LETTERING SIZE	INFORMATION
Switchboards, Panelboards, MCCs and other distribution system overcurrent devices	1/4" / 1/8"	Switchboard name designation, ampere rating of the supply conductors, voltage characteristics, power source and room number(s). EX: MDP, 1900A, 480Y/277V, Served from Utility EX: HVA, 175A, 480Y/277V, source DP-1,3,5. in Room 100.
Transformers	1/4" / 1/8"	Transformer name designation, load served, power source and room number(s). EX: Trans. TR-1, serves PANEL LV-1, source DP-7,9.11 in Room 203.
Remotely mounted Safety Switches and Starters	1/8"	Load served, power source and room number(s). EX: HWP-1, HVA 37,39,4 1 in Room 203. EX: PANEL LV-2 in Room 303, source TR-2.
Contactors	1/8"	Load served, power source and room nember(s). EX: Room 502, Science Lab, LVA 31,33 35, 37,39,4 1. EX: Building security lights, HVA 2, 4. EX: Parking lot lights, HVA 6, 8, 10.

L. Prepare a neatly typed panelboard circuit directory. Identify all circuits by the equipment served and by the room number, room numbers may be different from those shown on drawings. Verify room numbers prior to typing directories. Indicate spares and spaces with light, erasable pencil marking.

3.10 TESTING

A. Test and record results for all power feeders for Megger Readings, including phase to phase and phase to ground as recommended by the cable manufacturer.

B. Measure and record service ground resistance.

C. For equipment having ground-fault protection, the ground-fault protection system shall be performance tested when first installed on site. The test shall be conducted in accordance with instructions which shall be provided with the equipment. A written record of this test shall be made and shall be submitted to the Engineer and a copy put in the Operation and Maintenance Manuals.

3.11 CERTIFICATE OF COMPLETION

A. Submit, at time of request for final inspection, a completed letter in the following format:

I, (Name) , of (Firm) , certify that the electrical work is complete in accordance with Contract Plans and Specifications, and authorized change orders (copies attached) and will be ready for final inspection as of (Date). I further certify that the following specification requirements have been fulfilled:

1. Megger readings performed, six (6) copies of logs attached.

2. Ground tests performed, six (6) copies of method used and results attached, including service ground readings and ground fault test results.

3. Operating manuals completed and instructions of operating personnel performed for all systems, (Date) , (Signature, Owner's Representative).

4. Record drawings up-to-date and ready to deliver to Engineer.

5. Fire alarm system final connections, check-out and start-up completed on (Date) by (Signature, Factory Authorized Representative and Trained Technician) .

6. All other tests required by Specifications have been performed.

7. Final clean-up is completed.

8. All systems are fully operational.

Signed:_____

3.12 SITE OBSERVATION

A. Periodically, the Engineer will visit the site and review the construction progress. Field Reports will be issued noting any discrepancies or items that do not meet the intent of the contract documents found during said site visit. The contractor must answer each item listed on each field report, item by item.

B. It shall be the duty of the Contractor to personally make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the Owner, Architect or Engineer to make final acceptance of the work. Subsequent trips required because of Contractor's failure to do so, will be made at Contractor's expense, billed at current Engineer's hourly rates.

C. The final acceptance of the work will be made jointly by the Architect and the Owner.

D. Time spent for Investigation/Site Trips due to Contractor lack of installation capabilities/skills or knowledge is not part of Engineer's scope. Therefore, time spent assisting contractor in these matters or problems that arise due to these matters will be billed to Contractor. Engineer will bill the contractor at the current hourly rates of the Engineer. These fees will be paid in full prior to release of contingency.

3.13 DURING FINAL INSPECTION

A. Demonstrate installation to operate satisfactorily in accordance with requirements of Contract Documents.

B. Should any portion of installation fail to meet requirements of Contract Documents, repair or replace items failing to meet requirements until items can be demonstrated to comply.

3.14 CLOSE-OUT DOCUMENTS:

A. Furnish three signed letters of guarantee.

1. Clearly and individually, document all material, equipment and service guarantees beyond a single year.

B. Furnish one original and two copies, of a statement from the inspecting authority stating that the installation has been accepted and approved.

C. Furnish one reproducible, two copies and an electronic "AutoCad" version, of complete, full-size sets of drawings showing conduit locations by accurate dimensions from permanent structures.

1. **"Record** Drawings" are to include:

a. A sheet legend shall be present on the 1st sheet of the required set which identifies each sheet making-up the set.

b. Site plan(s) with primary and secondary electric power and communication lines to the property line (may be a civil sheet).

c. Site plan(s) with all underground conduits to other buildings, structures, fixtures and equipment.

d. Marked-up electrical plans and schedules.

D. Furnish three complete sets of overload settings and motor data records.

E. Furnish three complete sets of the electrical testing results.

F. Furnish three complete sets of the power system study final report.

G. Furnish all manufacturer's software if required for start-up or modifying products furnished.

H. Furnish two complete sets of the AC Drive's comprehensive manual that includes operation, programming, diagnostics, applications, wiring diagrams, layout diagrams, and outline dimensions.

1. Identify each AC Drive's model number on a cover sheet.

I. All major Owner training sessions to be videotaped in non-pixelated video in Windows file format.

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HENDRIX CONSULTING ENGINEERS

COMMISSIONING • FIELD INVESTIGATIONS

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PRE-CONSTRUCTION INSTRUCTION SHEET

Submittal/RFI Requirements

A. 'Individual submittals' means separate submittals with unique submittal numbers. One single giant PDF will be rejected.

B. 2 Submittal CATEGORIES (Reference Specifications)

a. Not required unless deviating from specification

b. PDF allowed.

PDF SUBMITTAL/RFI FILE TITLE REQUIREMENT:
For submittal sections listed below as allowed pdf's the following requirements must be met or the submittal will not get through email security and will be auto-deleted and not checked. Each pdf submittal must be a separate pdf file.

PDF FILE: MUST BE NAMED AS FOLLOWS:
JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION
JOB NAME – RFI No. XX – RFI DESCRIPTION

Example: Texas ISD ES No. 2 – Submittal 8 – Plumbing Fixtures
Example: Texas ISD ES No. 2 – RFI 3 – Library Light Fixture Mounting Height

EMAIL TITLE/SUBJECT REQUIREMENTS:
Emails without Job Name and proper format will not get through email security and will be auto-deleted and not checked.

JOB NAME – SUBMITTAL No. XX – SUBMITTAL DESCRIPTION
JOB NAME – RFI No. XX – RFI DESCRIPTION

C. If submittals are submitted early relative to construction phasing, submittals may be held, reviewed and returned at the appropriate time for construction phasing, not necessarily 2 weeks. In some cases, if submittals are received vastly out of order of construction, submittal may be rejected.

D. Time Critical Submittal Coordination Items

Mechanical to provide to General Contractor for Structural Roof Coordination

a. Mechanical to provide roof opening shop drawing as early as possible for structural coordination. Per specifications.

Mechanical to provide to General and Electrical Contractors for Gear Coordination

b. Mechanical to complete "MECHANICAL/ELECTRICAL COORDINATION SHEET" prior to electrical gear submittals for coordination with electrical contractor. Per specifications.

E. Do not submit non pre-approved substitutions during submittal time. These submittals will be automatically REJECTED. Substitution Pre-approval was at bid time.

F. Review time for multiple resubmittals of non-approved equipment will result in Contractor being billed for review time that is not part of Engineer's Scope. Engineer will bill Contractor at Engineer's Current hourly rates.

G. Email of all Submittals/RFI's must go directly to Architect. Do not Copy Engineer.

H. Engineer is not the Contractors plan reference resource. Do not submit an RFI until drawings and specifications have been reviewed first. If the answer is clearly on the drawings the response will be "The answer is clearly on the drawings, Engineer is not the Contractors plan reference resource."

I. Call before submitting a written RFI.

J. All formal Job emails must come from Architect.

K. Do not email send recurring jobsite meeting requests to Engineer. Engineer does not attend all weekly meetings. Architect will coordinate when Engineer is to be required at job site for specific meetings.

Shop Drawings and Cad Files

A. Contractor Shop Drawings must use Architectural Backgrounds and Architectural RCP's (when available or lighting floorplan) and **Mechanical Contractor Shop Drawings** for coordination purposes. Do not request MEP floorplans, this will be cut and paste into an email for you to read. Engineer cannot send architectural backgrounds.

B. If no Architectural RCP is available for light locations. Lighting Floorplans will be released.

C. Mechanical Floorplan will be released to Mechanical Contractor for aid in production of his own shop drawings. HCE mechanical drawings may not be submitted as shop drawings.

D. Fire Alarm, Sprinkler, Intercom etc. all to use Architectural Backgrounds, must be obtained from Architect.

E. Schedule and Details sheets will not be released.

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SUBSTITUTION REQUEST

FROM: _____ DATE: _____

PROJECT: _____

RE: _____

The following has been submitted for consideration on the aforementioned project:

Specification Title, Section, Page and Article/Paragraph:

Drawings and Details Affected:

Proposed Substitution/Description:

Installer's Name:

Manufacturer's name:

☐ Point by Point Comparative Data attached - REQUIRED BY A/E (_____# of pages including cover)

Why is Substitution Being Submitted?

☐Pre-Bid Substitution (Prior Appoval): Include detailed analysis comparing proposed substitution against specified product, including redlined Specifications showing differences or deviations.

☐Specified product is not available. Explain in detail as attachment.

☐Cost Savings to Owner. Indicate comparative cost analysis as attachment.

☐Other. Explain.

Effects of Proposed Substitution?

(Attach complete explanations and technical data, including laboratory test, if applicable.) Include complete information changes to Drawings and/ or Specification that proposed substitution would require for its proper installation. Fill in blanks below:

A. Does substitution affect dimensions shown on drawings? ☐No ☐Yes

B. Will undersigned pay for changes to building design, including engineering and detailing costs caused by requested substitution? ☐No ☐Yes

C. What affect does substitution have on other trades?

_____

D. Differences between proposed substitution and specified item?

_____

E. Indicate how proposed substitution meets LEED requirements. (if applicable)

F. Manufacturer's guarantees of proposed and specified items are:
☐Same ☐Different (explain on attachment)

The Contractor and Subcontractor certifies:
- Proposed substitution has been fully investigated and determined to be equal or superior in all respectes to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Similar maintenance service and source of replacement parts, as applicable is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted By: (name, address, telephone and contact person of manufacturer and installer of proposed substitution)

_____

_____

_____

_____

_____

For A/E Use: SR# _____

☐Accepted ☐Accepted as Noted

☐Not Accepted ☐Received Too Late

☐Incomplete Information

☐No Substitutions Accepted

Reviewed by/date: _____

Comments: _____

Subcontractor's signature and date: _____

Contractor's signature and date: _____

COPY TO:
☐FILE ☐OWNER ☐CONTRACTOR
☐ENGINEER ☐_____

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MECH / ELEC EQUIPMENT COORDINATION SHEET
(THIS IS REQUIRED – NOT OPTIONAL)

MARK #	UNIT TYPE	MANUFACTURER'S RECOMMENDED MOCP	VOLTAGE	PHASE	MARK #	UNIT TYPE	MANUFACTURER'S RECOMMENDED MOCP	VOLTAGE	PHASE

END OF SECTION

SECTION 26 05 10 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall breakdown the final Schedule of Values to be used for pay application into the following minimum categories.

B. ALL CATEGORIES SHALL HAVE APPROPRIATE MATERIAL AND LABOR BREAKDOWN.

C. Definitions:

1. Service: Conduit for utility company and conduit and wire from utility transformer to main switchboard.

2. Feeders: Include all conduit and wire serving transformers and panelboards.

3. Branch Circuit: Any circuit from a panelboard to a utilization device.

4. Gear: Main switchboard, panelboards, transformers, disconnects, etc.

5. Site conduit voice/data.

1.02 SCHEDULE OF VALUES

A. Mobilization

B. Utility Company Fees

C. Service - Wiring and Conduit

D. Gear

E. Exterior Lighting Fixtures

F. Interior Lighting Fixtures

G. Branch Circuit - Wiring and Conduit

H. Feeders - Wiring and Conduit

I. Devices (switches and receptacles)

J. Fire Alarm System

K. Testing/Labeling of Equipment

L. Record Drawings and O&M Manuals ($1500 minimum)

END OF SECTION

SECTION 26 05 19 - WIRE AND CABLE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide a complete system of conductors in raceway systems as shown on the drawings and hereinafter specified. Route all wire through an approved raceway unless otherwise indicated, regardless of voltage application.

B. Provide 200% neutral conductors to all panels with 200% neutral specified. Reference Panel Schedules.

C. Provide individual neutrals for each circuit, no shared neutrals allowed.

D. **No de-rating of neutrals allowed.**

1.02 STANDARDS

Provide conductors in accordance with the applicable sections of UL and IPCEA Standards.

1.03 SUBMITTALS

A. Furnish Engineer shop submittals for each type of wire and cable.

B. Provide shop submittals which includes the following information:

1. Insulation type.

2. Insulation temperature rating.

3. Manufacturer

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wire and Cables: (600 Volts)

1. Provide copper wire and copper ground conductors **only**. Conductors shown on plans are thusly sized. **No aluminum conductors** will be allowed unless specifically noted.

a. Minimum wire size for branch circuits shall be #12, however, #14 may be used for motor control circuits where specified on the drawings.

b. All conductors #12 and smaller shall be solid and #10 and larger shall be stranded.

2. Provide copper conductors of annealed, 98 percent conductivity soft drawn copper. Provide stranded conductors for control circuits.

B. Metal clad cable shall not be acceptable except from junction box to light fixture, maximum 6 feet in length.

C. Metal-clad cable shall not be acceptable for receptacles.

D. Insulation: (600 Volts)

1. Provide all conductor insulation types rated for wet and dry locations and approved by the National Electrical Code for the particular application. Provide all wire and cable with the following (or better) insulation classes:

   a. All feeders and branch circuits are to be dual-rated Type THHN/THWN **copper** conductors.

   b. Insulation rated for operation at 600 volts.

   c. In areas where the temperature will exceed 167^{O}F, provide wire rated 105^{O}C. minimum and a type approved by the local code. Include any wiring within three feet (3') horizontally or ten feet (10') above any heating appliance.

2. Color code in accordance with the wiring diagrams furnished with equipment. All wiring for control systems to be installed in conjunction with mechanical and/or miscellaneous equipment. Color code by line or phase all branch circuit wiring including circuits to motors and feeders as follows: Wire No. 10 and smaller shall be factory color coded. Wire No. 8 and larger may be color coded by color taping within six inches (6") of exposed ends. **Color coding for each nominal voltage shall be consistent throughout building from point of origination to the termination point including tap conductors to luminaire. Mixing of colors between voltages will not be allowed.**

120/208 Volt	120/240 Volts
Phase A - Black	Phase A - Red
Phase B - Red	Phase B – Orange
Phase C - Blue	Phase C – Black
Neutral - White	Neutral - White
Ground - Green	Ground - Green
	(Orange is High Leg)

E. Wire and Cable: (50 volts or less)

1. Provide copper wire, minimum size #18 AWG for controls, #18 AWG minimum for fire alarm and #20 AWG minimum for communications. All wire and cable shall be solid. Stranded conductors are not acceptable.

2. All conductors shall be routed in conduit or shall have an insulation approved for plenum installation, unless otherwise noted.

F. ROMEX not allowed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Unless otherwise indicated, wiring size noted on the drawings extends for the entire length of a circuit. Install wire in raceways in strict conformance with the manufacturer's recommendations. Use a UL approved wire-pulling lubricant. Strip insulation so as to avoid nicking of wire.

B. Wire Connections and Devices:

1. Provide all terminating fittings, connectors, etc., of a type suitable for the specific cable. Make all fittings up tight. Make up all terminations in strict conformance with manufacturer's recommendations using special washers, nuts, etc., as required.

2. Connect No. 8 and larger wire to panels and apparatus with properly sized, solderless, or compression lugs or connectors.

3. Join No. 10 and smaller wire by twisting tight and applying UL listed twist-on connectors.

4. Leave at least an eight inch (8") loop of wire for ends at each outlet box for the installation of fixtures or devices.

C. Flashover or insulation value of joints shall equal that of the conductor. Provide connectors rated at 600 volts for general use and 1000 volts for use within fixtures.

D. Grouping shall be 3 Hots and 3 Nuetrals or 6 Hots max. Derating shall be based on the 90 degree chart of NEC 310-16 and table 310.15 (B)(2)(2).

E. Where the distance between the supplying panel and the first branch circuit receptacle, light fixture or equipment is more than 100 feet, upsize wire to allow for maximum of 3% voltage drop for actual routing of conduit to device.

F. Wiring for emergency systems shall be kept entirely independent of all other wiring and equipment as required by Article 700 of the NEC.

G. Mechanically protect conductors by installing in raceways. Do not install the conductors until raceway system is complete and properly cleaned. Use an approved wire-pulling compound when pulling conductors. Wiring pulling compound shall be listed and as recommended by the conductor manufacturer. Do not bend any conductor either permanently or temporarily during installation to radii less than four times the outer diameter of the insulated conductors. Do not exceed manufacturer's recommended values for maximum pulling tension.

H. Pull conductors simultaneously where more than one conductor is being installed in the same raceway.

I. Use pulling means including fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway.

J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A.

K. Neatly and securely bundle all conductors in enclosures using nylon straps with a locking hub.

L. At least 6 inches (measured from the finished surface) of each conductor shall extend outside a box's opening.

3.02 SPLICES AND TERMINATIONS

A. Splices shall be kept to a minimum.

B. Splices shall be made in junction and/or pull boxes.

1. Splices in conduit fittings (i.e., conduit bodies), and in panelboards are not acceptable.

C. All materials shall prevent corrosion or electrolysis between dissimilar metals.

D. Use terminal blocks within a junction box for all splices of No. 6 and larger conductors.

E. Use mechanical, crimp or compression type connectors for terminations of stranded conductors.

3.03 CONDUCTOR SIZING

A. Install conductor size required by the more stringent requirements of the drawings or specifications.

B. Install No. 10 AWG conductors the entire length of the circuit for single-phase, 120-volt, 20-ampere branch circuits for which the distance from panelboard to the first outlet is more than 100 feet.

C. Install No. 10 AWG conductors the entire length of the circuit for single-phase 277 volt, 20-ampere branch circuits for which the distance from panelboard to the first outlet is more than 200 feet.

D. General use circuit numbers may be changed. Equipment circuits have numbering to balance loads. This contractor is responsible for maintaining a balanced load and recording the actual circuit numbers.

E. Comply with ampacity adjustment factors as required by the NEC Article 310-16.

3.04 TESTING

A. Prior to energizing feeders, perform insulation resistance tests at 500 Volts D.C. for 30 seconds on each cable with respect to ground and adjacent cables. Maintain the following log for feeder tests:

FEEDER DESCRIPTION:_____

TESTER'S NAME:_____

TEST INSTRUMENT SERIAL #:_____

TEST DATE:_____

RESISTANCE:

A-B	A-C	A-G	B-C	B-G	C-G

B. Test all circuits for proper neutral connections.

C. Upon completion of all testing, prepare a detailed report of all voltage and insulation resistance measurements. Deliver report to Engineer with request for final inspection.

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide copper clad 5/8" x 8 ft. - 0" long ground rods, appurtenances, bonding plates, clamps, connectors and grounding conductors as required. Furnish rods to which the copper cladding is permanently and inseparably bonded to a high strength steel core.

2.02 CONNECTORS

A. Provide exothermic weld type ground connections for concealed, underground, and concrete encased ground connections.

B. Exposed connections may be made with copper or bronze bolted or compression lugs.

2.03 INTER-SYSTEM GROUNDING BUS-BAR (communications)

A. Provide surface mounted terminal blocks sufficient to except 20 individual conductors of sizes 14 AWG thru 4 AWG.

2.04 CONDUCTORS

A. Furnish copper conductors.

B. Furnish 600-volt, insulated conductors for equipment grounding.

C. Size the system grounding electrode conductors to comply with NEC section and table 250-66, unless shown larger.

D. Size the main and separately derived system bonding jumpers to comply with NEC section 250-28 (D).

E. Size equipment grounding conductors to comply with NEC section and table 250-122, unless shown larger.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Properly ground all service equipment conduit systems, supports, cabinets, equipment, motor frames, fixtures, etc., and the grounded circuit conductor in accordance with the latest issue of the National Electrical Code. Provide all bonding jumpers and wire, grounding bushings, clamps, etc., as required for complete grounding. Route ground conductors to provide the shortest and most direct path to the ground electrode system. Bond conduit if made of current conducting material. All ground connections shall have clean contact surfaces. Bond the service equipment to a grounding electrode as shown on the Drawings.

B. Provide a grounding type bushing for all feeder and branch circuit conduits which do not have a grounding conductor and individually bond this raceway to the enclosure's ground bus or lug.

C. Provide a grounding type bushing on the end of each isolated section of metal conduit and bond the conduit to the equipment grounding conductor, or using a conductor of the same size, bond directly to the equipment ground buss of the equipment at the end of the run.

D. Make single or dual connections to ground rods, plates, and other buried connections by the exothermic process (Cadweld) or Burndy Hyground TM Compression Systems and "hammer tested" to insure that a good bond has been made. Alternatively, all below grade compression grounding systems must meet all UL467, CSA, IEEE837 test requirements and conform to the National Electrical Code Standards. The material at the connectors shall be pure wrought copper extrusions, rod and seamless tubing and be identical material to the conductor. Connectors must be of heavy duty design and be of range taking design to accept conductor ranges of #6 solid to 500 Kcmil plus 5/8" ground rods. Compression connectors need to be compressed with system engineered tooling which makes a circumferential or round crimp. Hex crimp is not acceptable due to sharp flashes and spurs that may occur. Each connector must be clearly marked with catalog number, conductor size and installation die information. Inspection ports must be provided on lug terminations and splices. The system must emboss all the appropriate die index numbers on all connectors after completion of the crimp. Connectors must be prefilled with penetrox copper type oxidation inhibitor and be individually sealed in clear polyethylene sheet to keep out dirt and contamination.

E. Drive grounding electrodes as required. Where rock is encountered, grounding plates of copper, 1/4-in. x 24-in. x 24-in may be used in lieu of grounding rods. Plates must be installed at 36" minimum below finished grade.

F. Connect grounding electrode conductor to building steel and metallic waterline per NEC 250-81. Allow a minimum of 25 feet of grounding conductor in foundation footing and make 3 connections to Rebar. Connections shall utilize an acceptable compression method with connectors listed for contact with respective metal types.

G. Provide a grounding terminal pad in all panelboards, switchboards, and other electrical equipment.

H. Directly ground to the work piece welding machines used in construction. The use of the building or equipment steel or conduits of any kind as a common ground point is not allowed under any conditions. Contractor is responsible for any electrical pieces of equipment damaged by not using the welder grounding method described above.

I. Provide a green insulated grounding conductor in all conduit serving receptacles and/or equipment. Refer to panelboard schedules for sizing.

J. Ground all receptacles to outlet box with a conductor.

K. Flexible conduit will not be allowed as a grounding means.

L. Install metallic fittings on clean contact surfaces to ensure electrical conductivity.

M. Tighten connectors, terminals, screws and bolts, in accordance with manufacturer's published torque tightening values or comply with torque tightening values specified in UL 486A to assure permanent and effective grounding.

N. Apply a corrosion-resistant finish to places where factory applied protective coatings have been damaged.

O. Protect all exposed, grounding electrode conductors with Schedule 40 PVC nonmetallic conduit.

1. Grounding electrode conductors shall not be protected with metallic materials.

3.02 GROUNDING ELECTRODE SYSTEM

A. At each building's service or disconnecting means, install a grounding electrode system which includes;

1. A concrete encased electrode connected to the concrete reinforcing bars and;

2. The building structural steel and;

3. The building's metal underground (10 ft.) water pipe.

a. This connection must be within the first 5 ft. of the water pipe's entrance into the building. Water piping cannot be the sole ground and must be supplemented.

4. Other electrodes such as a rod, plate or ring may be used to supplement but cannot be used as a substitute.

B. At each grounded separately derived system, install a grounding electrode conductor to connect the grounded (XO-neutral) conductor to;

1. The nearest one of the following electrodes:

a. An effectively grounded structural steel member or;

b. An effectively grounded metal underground (10 ft.) water pipe.

1) This connection must be within the first 5 ft. of the water pipe's entrance into the building.

2. If neither of these is available, install a 3/0, copper, common grounding electrode conductor from the building's service or disconnecting means. Connect taps from this common grounding electrode conductor to the separately derived system's grounded (XO-neutral) conductor.

3.03 SYSTEM BONDING

A. SERVICES

1. Install a main bonding conductor between the service ground bus and the grounded (neutral) bus-bar.

B. SEPARATELY DERIVED SYSTEMS

1. Install a bonding jumper between the equipment ground bus and the separately derived electrical system's (transformer, UPS, central battery/inverter or generator) grounded (XO-neutral) bus.

3.04 ADDITIONAL BONDING

A. Install 3/0 AWG bonding jumpers around all structural metal expansion joints.

B. Each building's interior metal water piping system which does not qualify to be used as a grounding electrode shall be bonded to the building's service or disconnecting means.

C. Bond the grounded (XO-neutral) conductor of each separately derived system to the nearest available point of the interior metal water piping system(s).

1. When the structural steel is being used as the grounding electrode for the separately derived system, the interior metal water piping system(s) may be bonded to the structural steel.

D. Install bonding jumpers around raceway expansion joints.

E. Install bonding jumpers around insulated water pipe joints.

F. Install a bonding jumper between all grounding electrodes used for communications, radio and television or antenna systems and the building's grounding electrode system.

3.05 COMMUNICATION GROUNDING

A. Provide a surface mounted, inter-system grounding bus-bar at the service equipment or a separate building's disconnecting equipment and in each communications room.

B. At the service or separate building's disconnecting means, provide an insulated 6 AWG, stranded conductor to connect the inter-system grounding bus-bar to the equipment ground bus.

C. At communications rooms, provide an insulated 6 AWG, stranded conductor to connect the inter-system grounding bus-bar to the building's structural steel.

3.06 EQUIPMENT GROUND

A. Raceways shall not be used as the sole equipment ground.

B. Bond the equipment grounding conductors to all boxes and enclosures.

C. Each receptacle shall be bonded to its respective device box. The connection shall be made by means of a bonding jumper between the device and the box. Where the receptacle mounting yoke is designed and listed for the purpose of grounding, the bonding jumper may be omitted. This does not substitute for the need of grounding the outlet box.

D. Each isolated ground receptacle shall have an isolated ground conductor installed complete from receptacle to the isolated ground bus in the panelboard. No other grounding connections shall be made to these receptacles, specifically connections to the device box or raceway system.

3.07 TESTING

A. Following completion of installation, test system ground for continuity and test resistance to ground by "fall of potential" method and all feeders or sub-feeders with appropriate meggers, or other approved instruments and methods, to determine ground and insulation resistance values.

B. Submit logs of values obtained, nameplate data of instruments used and instrument calibration data prior to final inspection. Instruments used are subject to acceptance.

END OF SECTION

SECTION 26 05 29 – HANGER & SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all required supporting devices, including but not limited to channels hangers, brackets, fittings, clamps, hardware, anchor bolts, rods, electrical accessories, etc., for conduit and equipment.

1.02 STANDARDS

A. Conform with the latest requirements of the NEMA and The National Electric Code.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Support Channel: Hot-dipped galvanized steel, sized for load, minimum size 12 gauge, 1-5/8 wide by 13/16 deep. Furnish fasteners sufficiently sized to carry load imposed.

B. Hardware: Corrosion Resistant (Hot-dipped galvanized all steel components)

C. Support Wires (16 Ga. Minimum) and Tie Wires (22 Ga. Minimum) or as required by UL listed assemblies: Galvanized Steel

D. Coatings: All steel components shall be hot-dipped galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Perforated iron straps are not permitted for supporting conduits. Conduits run between the webs of bar joists may use galvanized tie wire for securing the conduits. Cut excess wire and bend ends to prevent sharp ends.

B. Support horizontal and vertical conduit runs by one-hole straps, clamp-backs or other acceptable devices and suitable bolts. All conduits shall be secured to structure with supporting devices dedicated for the electrical system and/or conduits for systems furnished under the Electrical Contractor responsibilities. When two (2) or more conduits are run parallel, they may be supported on trapeze hangers, equal to the Modern Co. Other hangers shall be constructed with rods and hanger adjusters of adequate size to carry the loads imposed.

C. All conduits shall be supported a maximum of ten feet (10') on center. Also, support conduits within twelve inches (12") of any bends, outlet boxes, wall penetrations or joints in pipe. All conduits shall be secured to structure. Lighting fixture whips may not be secured to ceiling tie wires. Vertical risers shall be supported by approved riser clamps or supports installed at the respective floor lines

D. Conduits routed below bar joists shall utilize acceptable clamps.

E. Fasten hanger rods, conduit clamps and outlet and junction boxes to building structure using precast insert system, expansion anchors, preset inserts, or beam clamps. Do not use spring steel clips and clamps. Submit method of attachment for review prior to commencing work.

F. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheetmetal screws in sheetmetal studs; and wood screws in wood construction.

G. Do not fasten support wires to piping, ductwork, mechanical equipment or conduit.

H. Do not fasten conduit or junction boxes to ceiling grid wire. All conduit must be independently supported.

I. Support recessed fluorescent light fixtures with support wire at all four corners as required by roof/ceiling assembly. If roof/ceiling assembly does not require supports at each corner, support fixtures with minimum of two support wires at diagonally opposite corners. Spray paint ends of fixture support wires orange.

J. Conduits, except as approved by NEC, shall not be used to support low voltage cables.

K. Support all piping on roof with pipe stands/roller equal to MIRO Industries Model 4-RAH-PC or Portable Pipe Hangers, Inc., Type PP10 with roller for conduit 2-1/2" and smaller. For conduit over 2-1/2", up to and including 4" use MIRO Industries Model 6-RAH-PC or Portable Pipe Hangers, Inc. (PPH) Type PS-1-2. All conduit stands to sit on walk board (coordinate type and methods of support with Roofing Contractor). Provide minimum pipe height above roof deck as required by jurisdiction having authority (at least 3-1/2"). Provide supports for piping under 2" at six feet on center. Provide supports for conduit 2" and over at eight feet on
center.

L. Provide all angles, unistrut supports and threaded rods under any structural elements or mechanical equipment where required for proper placement and support of light fixtures and/or conduits.

M. Supports and hangers shall be installed to permit free expansion and contraction in the raceway systems. Where necessary to control expansion and contraction, the raceways shall be guided and firmly anchored. Anchors shall be approved by the Engineer and shall be designed for equal effectiveness for both longitudinal and transverse thrust. No conduit shall be self-supporting, nor shall it be supported from equipment connections. Transmission of vibrations, noise, etc., shall be considered and any special suspension with vibration dampers to minimize transmission shall be used where necessary.

N. Where ducts interfere with the proper location of hangers, furnish and install trapeze hangers. Trapeze hangers may be used to support groups of conduit run in parallel.

O. Install metal framing to support wall mounted equipment and wall or ceiling mounted raceways.

P. Install expansion bolts to attach framing to concrete. Space bolts a maximum of 24 inches on center, with not less than two bolts per piece of framing.

Q. Touch up all scratches or cuts on steel components with an approved zinc chromate or a 90 percent zinc paint.

END OF SECTION

SECTION 26 05 33 - RACEWAYS

PART 1 - GENERAL

1.01 SCOPE OF WORK

Provide a complete conduit system as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

Conform with the latest requirements of the NEMA, the National Electrical Code, and be UL listed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Rigid Metal Conduit (RMC): Hot-dip galvanized, threadable steel raceway, galvanized after fabrication. Fittings shall be malleable iron, either cadmium plated or hot-dip galvanized.

B. Intermediate Metal Conduit (IMC): Conduit shall be similar to rigid steel conduit except thinner wall. Fittings shall be malleable iron, either cadmium plated or hot-dip galvanized.

C. Electrical Metallic Tubing (EMT): EMT shall be made of hot-dip galvanized strip steel. Fittings shall be steel or die cast compression or set screw type.

D. PVC - Schedule 40 and Schedule 80 polyvinyl chloride conduit (PVC Duct) shall be UL rated. Conduit fittings and cement shall be produced by the same manufacturer and approved for such use.

E. Flexible Metal Conduit (FMC): Spirally wound continuously interlocked zinc coated strip steel. Fittings shall be steel or die cast zinc, either screw-in or squeeze type.

F. Flexible Conduit (LFMC): Liquid-tight (vibration and/or wet areas) fabricate from continuous lengths of spirally wound galvanized steel strip interlocked with a gray polyvinyl chloride cover extruded over the core to make the conduit liquid tight, oil proof and bendable to a small radius. Fittings shall be compression type, steel or die cast zinc, with insulated throat.

G. Metal-Clad Cable (MC): Galvanized interlocking steel armor. 600 volt, type THHN/THWN, integrally colored insulation. Size #12 AWG or #10 AWG, copper conductors. Fittings shall be listed for MC usage and include anti-short bushings. Reference Section 3.03 for acceptable uses.

H. Metal Wire-ways.

1. Furnish with wire retainers on not less than 12 inch centers. All screws installed towards the inside shall be protected to prevent possible wire insulation damage.

2. The finish shall be the manufacturers' standard color and shall consist of not less than two coats of enamel over a rust-inhibiting prime coat.

I. Surface Metal Raceway (2000 series).

1. Surface metal raceway shall consist of a single compartment base, blank cover, and appropriate fittings to complete the installation per the electrical drawings.

2. The base and cover shall be manufactured of steel and finished with a white color.

3. Approximately ¾" deep, 1 ¼" high and 5' sections.

J. Non-Metallic Multi-outlet Assemblies (5400 series).

1. Surface raceway system shall consist of a dual compartment raceway base, twin cover, appropriate fittings, outlets and device mounting plates necessary for a complete installation.

2. Duplex receptacles and data outlets ("activate connectivity inserts") mounted at 24" centers or as noted on plans. Connect adjacent receptacles on alternate circuits.

3. Approximately 1 ¾" deep, 5 ¼" high and 8' sections with equal compartments.

4. The finish shall be white color and shall consist of not less than one coat of enamel over a prime coat.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Raceway and cable usage and installation shall conform to the appropriate article of the National Electrical Code (NEC), as a minimum.

B. Do not install conduit that is crushed or deformed in any way.

C. Provide a nonmetallic (nylon, polypropylene, or approved equal) drag line of suitable strength in spare conduits and telephone conduits. Tightly plug spare conduits at both ends.

D. Do not pull wire into conduit system until the conduit system is complete in all details; in the case of concealed work, until all rough plastering or masonry has been completed.

E. No wiring systems of any type shall be installed in ducts used to transport dust, loose stock, or flammable vapors.

F. No wiring system of any type shall be installed in any shaft containing ducts used for vapor removal or for ventilation of commercial-type cooking equipment.

G. Fasten and support the wiring method employed to the permanent structure using listed straps with corrosion resistant hangers and fasteners.

H. Ceiling system wires or lay-in type ceiling grid components shall not be used as a means of support.

1. Independent support wires and associated fittings which are installed in addition to the ceiling system support wires, shall be permitted: (300.11.A)

2. Independent wires within the cavity of a fire-rated floor–ceiling or roof–ceiling assembly shall be distinguishable by color. (300.11.A.1)

3. Independent support wires that provide support for device boxes shall be secured at both ends. (300.11.A).

I. Bends shall be made with factory elbows or field bent. Field bends shall be made using equipment designed for the particular raceway material and size. Bends shall be free from dents or flattening.

J. Conduit bodies may be used in lieu of conduit elbows where covers will be accessible, and ease of installation and appearance warrants their use.

K. Install expansion-deflection fittings where raceways cross structural expansion joints or where required to compensate for thermal expansion and contraction. Install bonding jumpers across expansion-deflection fittings in metal raceway systems.

L. Openings through fire-resistant-rated or sound-resistant-rated walls, partitions, floors or ceilings shall be fire-stopped by installing raceways or cables through sleeves set through the walls, partitions, floors or ceilings and fire-sealing all openings and voids around the sleeves, raceways and cables.

M. Do not drill or pierce structural steel members under any circumstances without the Engineer's specific approval.

N. Minimize roof penetrations by routing conduit through the equipment roof opening. If roof penetration is necessary, coordinate with the Architectural Specifications and penetrate as directly below the equipment disconnect or wiring connection point as possible. Do not use flexible conduit in a pitch pan.

O. Arrange all conduits to drain away from the building.

P. Perform all necessary excavation and backfilling. Tamp backfill in six inch (6") layers to original grade, moistening as required for proper compaction. All backfilling shall be free from harmful materials. Provide shoring, bracing, and de-watering as necessary. Remove all excess and materials not suitable for backfill from the site. Provide barricades to prevent endangering the public. Provide warning beacon lighting at night to adequately mark all excavations.

Q. A tracer tape wire shall be installed in all trenches which do not contain conductive conductors within them. This will include future use raceways, optical fiber, etc.

R. Raceway systems shall be complete before installing conductors.

S. The interior of all raceways shall be cleaned before installing conductors.

T. Terminate future use raceways with a capped coupling within an accessible area.

U. Workmanlike manner: Type MC cable shall be installed in a neat and workmanlike manner. Cable shall not cross other cable or have excess slack. Cable that is installed vertically, must be plumb with the vertical framing of the structure.

V. Bundling of cable is limited to three cables for each support ring.

W. Type MC cable may be only supported by fasteners or clamps that are approved and UL tested for cable support.

3.02 INSTALLATION BELOW GRADE

A. Minimum size raceway is 3/4 inch.

B. Provide rigid galvanized steel conduit or PVC where conduits are installed in concrete floor slab ¾" maximum. Maintain proper concrete coverage as directed by structural engineer. PVC conduit shall not penetrate slab above finished grade.

C. Provide rigid galvanized steel or PVC conduit where conduits are installed below grade.

D. Swab clean all conduits before cable installation. Waterproof all conduit joints after cable installation.

E. Provide conduit wall sleeves for all conduits penetrating walls, grade beams, etc. and other locations shown on the Drawings.

F. Where required to bend PVC ducts to satisfy indicated routing, preform ducts to allow ends of duct sections to be in a straight alignment. Accomplish preforming of ducts by utilizing proper duct heater units.

G. Perform all necessary excavation and backfilling for proper installation of work. Take precautions not to excavate below depth required. Backfill trenches with sand, 3" below conduits and 3" above. Tamp remainder of backfill in six inch (6") layers to original grade, moistening as required for proper compaction. All backfilling shall be free from harmful materials. In areas to be paved, compact to density to receive pavement. Where pavement is broken for the installation of conduit, repair to original condition. Provide shoring, bracing, and de-watering if necessary for installation of work. Remove from site all materials encountered which are not suitable for backfill.

H. When and if damage is caused to underground utility lines or structures, above ground utility lines or structures, or other purposeful surface conditions, either on or off the right-of-way, make immediate temporary repairs. At the first opportunity, make permanent repairs which are acceptable to the Owner. All such repairs shall be made at the Contractor's expense.

I. Where necessary, provide barricades around open excavations to prevent endangering the public. Provide warning beacon lighting at night to adequately mark all excavations.

J. Where conduits embedded in concrete floor or roof deck cross expansion joints, they shall be joined together using O.Z. Gedney type DX expansion fittings and bonding jumpers. Straight runs of conduit over 150' long shall have O.Z. Gedney Type AX expansion fittings installed to minimize movement. Fittings shall be installed at a maximum of 150' on center.

K. Where horizontal runs of conduit transition to vertical and continue above finished grade or finished floor; the transition shall be made with a 90 degree long radius sweep. The sweep may be PVC (2" and smaller) and shall be RMC (2-1/2" and larger). No PVC conduit will be allowed above finished grade or finished floor.

L. CONDUITS RUN BELOW FINISHED FLOOR SHALL NOT PENETRATE GRADE BEAMS. UNLESS APPROVED BY STRUCTURAL ENGINEER.

3.03 PERMITTED RACEWAY USAGE:

A. Raceway transitions at all locations;

1. Rigid nonmetallic conduit runs from below grade level shall transition to galvanized rigid steel or intermediate steel conduit, wrapped with corrosion protection tape, prior to exiting at grade level and continue thereafter in accordance with their usage requirements.

a. Caulk concrete-to-conduit joints with a silicone rubber compound.

2. Continue the more protective conduit type into an area where a less protective conduit type is permitted for a distance of not less than 1 foot.

B. Electrical metallic tubing at;

1. Interior locations when;

a. Concealed within walls and ceilings or; **do not use in the mortar filled cells of concrete masonry units.**

b. Exposed and more than 8 feet above finished floor or;

c. Exposed and more than 3 feet above finished floor in electrical or mechanical rooms or;

d. Exposed and more than 1 foot above a finished attic or mezzanine floor.

e. Do not use where exposed to standing water or other continuously damp or wet areas.

2. Exterior locations when;

a. More than 10 feet above the finished ground surface or;

b. More than 1 foot above the finished ground surface within a lockable equipment yard or;

c. In the crawl space below a building with the 1st level elevated.

C. Rigid or intermediate metal conduit at;

1. Interior locations when;

a. Exposed, in other than electrical or mechanical rooms, and installed less than 8 feet above finished floor or;

b. Exposed in electrical or mechanical rooms and installed less than 3 feet above finished floor or;

c. Exposed and less than 1 foot above a finished attic floor or mezzanine floor.

2. Exterior locations when;

a. Less than 10 feet above the finished ground surface or;

b. Less than 1 foot above the finished ground surface within a lockable equipment yard.

1) Malleable iron straps will be required at these locations.

D. Rigid metal and intermediate metal conduit wrapped with corrosion protection tape or rigid nonmetallic conduit at;

1. Underground locations with a ¾" minimum size when;

a. Located outside of the building line or;

b. Located below a concrete slab on grade or;

c. Located below a beam of a slab on grade or.

d. Located within a concrete slab on grade where the outside diameter is equal to or less than 20 percent of the slab thickness.

1) Seal conduit ends at each building entry.

2. Below grade;

a. The minimum size shall be 3/4 inch.

b. Seal conduit ends at each building entry.

c. Coordinate covering with Structural Engineer.

E. Rigid nonmetallic conduit for;

1. An exposed grounding electrode or bonding conductor below 10 ft. to guard from physical damage.

F. Flexible metal conduit in;

1. Dry interior locations with a minimum length of 2 feet and maximum length of 6 feet to;

a. The final connection of transformers, motors and vibrating equipment.

G. Flexible metal conduit or metal-clad cable for light fixtures or ceiling mounted devices.

1. Dry or damp interior locations with a maximum length of 6 feet to;

a. The final connection of light fixtures; or

b. The final connection of ceiling mounted outlet boxes or.

H. Flexible metal conduit is not allowed for any technology rough-in, must be EMT.

I. Liquid-tight flexible metal conduit in;

1. All locations with a minimum length of 2 feet and maximum length of 6 feet for;

a. The final connection of all liquid pump motors and associated control connections or;

2. Damp or wet interior and all exterior locations with a minimum length of 2 feet and maximum length of 6 feet to;

a. The final connection of transformers, motors, and vibrating equipment.

END OF SECTION

SECTION 26 05 34 - OUTLET BOXES, PULL BOXES AND JUNCTION BOXES

PART 1 - GENERAL

1.01 SCOPE OF WORK

Provide outlet boxes in accordance with the National Electrical Code at locations shown on the Drawings and hereinafter specified.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide standard hot-dipped galvanized pressed steel boxes, minimum 4"x4" by 1-1/2" deep. Use 4 11/16" by 2 1/8" deep box when using 1" conduit.

B. Cabinets with screw covers or as specifically noted for junction or pull boxes larger than 150 cubic inches.

C. All junction, pull and splice boxes to conform to NEC Article 314.

D. All metallic boxes are to have an internal means of grounding.

E. Flush mounted wall and finished ceiling boxes.

1. Within framed, drywall, plastered or tile covered walls, with ¾" max. raceway, furnish galvanized steel, 4" square, minimum 1 1/2 inch deep boxes with a raised tile cover and a far-side support.

2. Within drywall or plaster covered or suspended ceilings, with ¾" max. raceway, furnish galvanized steel, 4" square, minimum 1 1/2 inch deep boxes with a raised tile cover.

3. Within masonry walls, with ¾" max. raceway, furnish galvanized steel boxes, minimum 2-1/2-inch deep.

F. Surface mounted boxes.

1. Mounted at or below 10' above the finished surface, ¾" max. raceway size, furnish cast aluminum boxes with a surface mounted cover.

G. Junction and Pullboxes.

1. Furnish, minimum 4" square, 1 – ½" deep, galvanized steel junction and pullboxes where installation conditions warrant their use. Boxes shall be furnished with screw-on covers or hinged covers. Covers shall be such that it can easily be handled by one person. All hardware and fasteners shall be galvanized steel.

H. Flush mounted floor boxes.

1. Furnish adjustable, concrete tight, corrosion resistant, duplex type. Compartmental type for combination receptacle and communication. The coverplate shall be brass with hinged flap and carpet flanges. The minimum below ground/slab conduit size shall be ¾".

I. Underground boxes.

1. U. L. listed.

2. Pre-cast, polymer concrete.

3. Minimum size of 10" W X 10" L X 10" H.

4. Bolt down cover.

5. Stainless steel hex-bolts and replaceable nuts.

6. Minimum load rating of 5,000 lbs. (select by location)

PART 3 - EXECUTION

3.01 INSTALLATION

A. Through wall boxes and boxes mounted back-to-back are not permitted. Provide 8 inch minimum separation in order to minimize sound transmission.

B. Set flush with wall or ceiling finish in accordance with N.E.C., Article 314. Extension sleeves are not permitted for boxes improperly set.

C. Verify location of outlets prior to rough-in. When necessary, relocate outlets to avoid interference with other work or equipment. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture. Fit outlet boxes in finished ceilings or walls with appropriate covers.

D. Where more than one (1) switch or device is located at one (1) point, unless otherwise indicated, provide gang boxes and covers. When the voltage between switches exceeds 300 volts, provide barrier partitions between adjacent switches located in the same box. Sectional switch boxes or utility boxes not permitted.

E. Provide pressed steel boxes for all interior work. Provide square boxes with plaster rings. Provide appropriate size multi gang box for group devices. Single gang boxes screwed together is not acceptable.

F. Where boxes are installed in masonry walls, use only approved masonry type boxes for single gang and multi-ganged applications. Standard 4" square boxes with plaster rings are not allowed. Caulk around joint between receptacle box and masonry. Verify color with architect.

G. Do not drill and pierce structural concrete members and structural steel without prior approval of the Engineer.

H. Mount all boxes plumb.

I. Mount boxes completely rigid without conduit or finished wall support.

J. Where outlets are installed in steel stud type systems, provide additional cross bracing, bridging, and/or straps as required to make the outlet completely rigid. Support boxes with "caddy screw gun brackets", "caddy box mounting bracket", "caddy quick mount box brackets" or acceptable alternates.

K. **Dimensions are from finished floor to centerline of outlets.** Adjust heights of outlets in masonry walls from that indicated so that receptacles are not lower than 16" A.F.F. and switches are not higher than 48" A.F.F. Outlet height so adjusted shall be consistent. Unless otherwise indicated, mount outlets at the following heights:

Wall switches/Wall Phone	4 ft. - 0 in.
General Duplex receptacles	1 ft. - 6 in.
Receptacles at Millwork	verify with millwork
Receptacle for Refrigerators	2 ft – 6 in.
Weatherproof duplex receptacles	1 ft. - 6 in.
Telephone/Data outlets/Teacher Station	1 ft. - 6 in.
Telephone/Data at millwork	verify with millwork
Garages/Apparatus Bay receptacles	2 ft. - 0 in.
Clocks	8 ft – 0 in
Access Point Data Drops (wall mounted)	10 ft – 0 in

L. For boxes installed above ceilings, label the box cover with the circuit numbers installed. Labeling shall be with a permanent, black maker with broad tip.

M. Boxes installed in rated walls shall have a minimum horizontal separation of 24". Maximum surface area of boxes shall not exceed 16 square inches.

N. Completely envelope floor boxes in concrete except at the top. Increase slab thickness at boxes if required for bottom covering. Adjust covers flush with finished floor.

O. Where outlets are indicated adjacent to each other, mount these outlets in a symmetrical pattern with all tops at the same elevation. Where outlets are indicated adjacent, but with different mounting heights, line up outlets to form a symmetrical vertical pattern on the wall.

P. Install recessed boxes flush to the finished wall or ceiling line by the use of manufactured tile rings to extend the box forward.

Q. Boxes to which light fixtures or pendants are mounted shall NOT contain any conductors foreign to the operation of such light or pendant application. Removal of lights, pendants and cord drops to access other branch circuits is NOT acceptable.

R. Where fixtures are mounted on or in an accessible type ceiling, provide a junction box and extend flexible conduit to each fixture.

S. Install knockout closures to cap all unused openings.

T. All boxes shall be installed with coverplates.

U. Install boxes as required to facilitate conductor installation in raceway systems. Junction and pull boxes shall be sized to accommodate conductors, splices, devices and fittings per NEC 314.16.

V. Raceways are NOT allowed to terminate to extension rings.

W. Install boxes so that covers are accessible and easily removable after completion of the installation. The minimum clear space in the direction of the box opening shall be 36".

X. Include suitable access doors, with the proper fire rating, for boxes above inaccessible ceilings. Boxes shall be located within reach of the access.

Y. Install underground boxes with cover slightly above finished grade.

Z. Spray paint J-Boxes red for Fire Alarm Systems. All other special system J-Boxes to be painted white.

END OF SECTION

SECTION 26 05 80 - EMPTY RACEWAY ROUGH-IN

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install all equipment, accessories and material required for the rough-in of empty raceway systems in accordance with the specifications and drawings.

B. Rough-in raceway sections for indicated devices and outlets in all walls, floors and underground sufficient to facilitate installation of the following systems without cutting or otherwise damaging walls, ceilings or floors installed in this contract:

1. Communications
2. Fire Alarm
3. Television
4. Data
5. Security
6. Controls

C. **ALL** CONDUITS SHALL HAVE A PULL CORD INSTALLED. INSTALL BLANK COVERS ON ALL UNUSED JUNCTION BOXES.

D. 3/4" CONDUIT MINIMUM.

E. Electrical Contractor shall provide all conduit, junction boxes and outlet boxes for HVAC controls as specified in Section 26 05 00, 1.03, D. Coordinate locations and requirements with Mechanical Contractor and Controls Contractor prior to rough-in. Provide outlet box for sensor and conduit to above accessible ceiling. Provide conduit for all wiring in areas with no ceiling. Provide conduit from outdoor units to above accessible ceilings. Provide conduit between make-up air units and associated condensing units.

F. REFERENCE TECHNOLOGY DRAWINGS AND SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS CONCERNING CONDUIT ROUGH-IN FOR VOICE/DATA SYSTEMS.

G. Floor mounted devices: Provide pathway to nearest accessible ceiling for all floor mounted devices called for in this specification.

1.02 QUALITY ASSURANCE

A. Construct each item of equipment, including parts and accessories, in a workmanlike manner, using new materials or the best quality obtainable for the purpose intended. Design and build materials in accordance with the best practices of the electrical industry.

B. Comply with all requirements of serving utility.

PART 2 - EXECUTION

2.01 INSTALLATION

A. Interior conduit systems shall have runs less than 100 feet from point to point.

B. Provide accessible pull boxes when necessary. Provide blank covers for all outlet boxes, unless otherwise noted.

C. All bends for telephone and cable television service shall be 36 inch radius, minimum.

D. Provide outlet box in wall at 18" A.F.F. (UON) and conduit with string to above accessible ceiling location. Provide insulated bushing on end of conduits.

E. Provide twelve (12) additional outlet boxes and conduit with pull cord to above the ceiling. Final location shall be as directed by the Architect. Outlets can be added at any phase of construction with the exception of finished CMU walls.

END OF SECTION

SECTION 26 15 00 - ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Electrical demolition.

PART 2 - EXECUTION

2.01 EXAMINATION

A. Demolition Drawings are based on field observations and existing Record Documents. Report discrepancies to Architect/Engineer before disturbing existing installations.

B. Verify field measurements and circuitry arrangements prior to starting demolition.

C. Verify that wiring and equipment to be abandoned serve only abandoned facilities.

D. Beginning of demolition means the Contractor accepts existing conditions.

2.02 PREPARATION

A. Disconnect electrical systems in walls, floors, ceilings, etc. scheduled for removal. Reference Architectural drawings and specifications for limits of demolition.

B. Coordinate utility service outage with Utility company and the Owner, prior to starting demolition.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

2.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove abandoned wiring, conduit and appurtenances to source of power (panelboard) or previous device, including conduits, wiring and appurtenances above accessible ceilings.

B. Remove, relocate and extend existing installations to accommodate new construction.

C. Cut conduit flush with walls and floors, and patch surfaces. Reference Architectural Specifications for repairing and painting requirements.

D. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

E. Maintain access to existing electrical installations which remain active. Modify installation or provide access panels, as required.

F. Extend existing installations, as required, using materials and methods as specified or that is compatible with existing electrical installation.

2.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which are to be reused.

1. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuitry arrangements.

2. Luminaires: Remove designated existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace all ballasts, lamps and broken electrical parts and/or lenses, as required.

END OF SECTION

SECTION 26 24 16 - BRANCH CIRCUIT PANELBOARDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide branch circuit panelboards as shown on the Drawings and as herein specified.

B. Panelboard feeders are sized from the "Panelboard Connection Schedule". When a panel is fed from a transformer use the "Transformer Connection Schedule" for feeder size. When there is a conflict between the sizes, use the largest of the two.

C. This section specifies the furnishing and installation of molded case, thermal-magnetic circuit breakers. Electronic, solid-state trip circuit breakers are NOT allowed.

D. Maximum circuits per panelboard section shall be 42 circuits.

1.02 STANDARDS

A. Provide U.L. label.

B. Comply with applicable standards of NEMA and the NEC.

1.03 ACCEPTABLE MANUFACTURERS

A. Square D/Schneider Electric

B. ITE Siemens

C. Cutler Hammer/Westinghouse/Eaton

D. General Electric

1.04 SUBMITTALS

A. Furnish Engineer shop submittal for each branch circuit panelboard.

B. Submit shop drawings for each panelboard which include outline and support points, dimensions, voltage, main bus ampacity, short circuit ampere interrupting rating, circuit breaker arrangement, sizes and number of poles. Shop drawing shall list all spaces and circuit breakers to be installed in each panelboard.

C. Provide shop submittal which includes the following:

1. Cabinet

a. Housing

b. Trim

c. Outline dimensions

d. Available spaces

e. Panelboard mounting

2. Circuit breakers

   a. Frame size

   b. Trip setting

   c. Class

   d. Interrupting rating in RMS Symmetrical amperes

   e. Mounting

   f. Voltage rating

3. Busing

   a. Ampere rating

   b. Material

   c. Incoming cable lug size

   d. Bus bracing

4. Manufacturer's catalog numbers.

5. Other descriptive data as may be required.

D. Circuit breaker arrangement must be identical to the schedules or one line diagram, unless there is a technical reason for deviation. All reasons for deviation must be stated on the shop drawings.

E. Unless specifically noted, only Max 42 circuits per section will be allowed.

PART 2 - PRODUCTS

2.01 GENERAL.

A. All new panelboards and switchboards on this project shall be by the same manufacturer. The manufacturer shall be the same as the manufacturer of the circuit breakers.

B. Interior trim shall be of dead-front construction to shield user from energized parts. Dead-front trims shall have pre-formed covers for unused mounting space.

C. Interior leveling provisions shall be provided for flush mounted applications.

D. Panelboards shall be designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.

F. Furnish suitable lugs for each conductor requiring a connection.

2.02 BUS CONSTRUCTION

A. Fabricate all buses of 98 percent IACS conductivity, copper. Size buses to limit their temperature rise within the panelboard to 65°C based on a 40°C ambient temperature.

B. Provide one continuous, un-reduced in size, bus bar per phase with “distributed phase” or “phase sequence” type connections to the branch circuit breakers. Extend the buses the height of the panelboard.

C. Provide circuit breaker connections to the bus by means of a bolt. Square D “I-Line” may be provided.

D. Insulate each individual phase bus to withstand 2000 volts a-c for 1 minute.

E. Support the bus systems using non-carbonizing, non-tracking insulators.

F. Furnish fully equipped spaces, include all appropriate connectors or mounting hardware.

G. Furnish an insulated neutral bus which is the same size as the phase buses. Larger sizes may be required by the schedules or one line diagram.

H. Furnish a solidly bonded equipment ground bus. Include terminals for feeder and branch circuit grounding conductors.

I. Furnish an isolated ground bus, with terminals, where scheduled or noted on the drawings.

J. Provide full size or larger insulated neutral bus bar. Where specified on the panel schedule, provide 200% rated neutral bus bar. Coordinate with plans.

2.03 RATINGS

A. Panelboards and circuit breakers shall be rated for 60 hertz and have a voltage and current rating as indicated on the drawings or schedules.

B. The finished panelboard assembly shall be fully rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault currents indicated on the drawings or schedules. The minimum rating for a 240 volt a-c panelboard shall be rated 10,000 AIC RMS symmetrical and a 480 volt a-c panelboard shall be rated 14,000 AIC RMS symmetrical minimum. Series ratings are not permitted.

C. Final AIC ratings for all panels shall be determined and provided by the gear manufacturer to meet minimum allowable fault current from utility company transformer. Provide coordination study and fault current analysis as required for justification of sizes. Make all changes required by coordination study and include in bid price. Coordination study must be completed prior to submitting gear.

2.04 ENCLOSURES

A. Enclosures shall be at least 20 inches wide and made from galvanized steel with welded interior mounting studs. Provide gutter space in accordance with the National Electrical Code. Where conductors are carried through a box, the box shall be sized to include the additional space. Enclosures shall be fully enclosed.

B. **ALL MULTI-SECTION PANEL ENCLOSURES SHALL BE THE SAME HEIGHT.**

2.05 HINGED FRONT COVER

A. Mounting shall be flush or surface, as indicated on associated schedules or drawings. Surface trims shall be the same height and width as the box. Flush trims shall overlap the box by 3/4 of an inch on all sides.

B. Fronts shall be of the concealed hinged type. Front shall not be removable with the door closed.

C. Doors on front shall have rounded corners; edges shall be free of burrs. Doors shall have a flat latch type lock with a catch and spring loaded stainless steel door pull. All lock assemblies shall be keyed alike. One key shall be provided with each lock.

D. Furnish a nameplate, circuit directory frame, card and a clear plastic covering on the inside of the door. All loads shall be identified as specified in Section 16075.

2.06 FINISH

A. Surfaces of the trim assembly shall be properly cleaned, primed, and a finish coat of gray paint applied.

B. Nema 3R enclosures shall be properly cleaned, primed, and a finish coat of gray paint applied.

C. Supply one quart of finish paint for each project. Touch-up after installation.

2.07 MOLDED CASE THERMAL-MAGNETIC CIRCUIT BREAKERS

A. Furnish molded case, thermal-magnetic circuit breakers in lighting / appliance and power distribution panelboards for the specified service with the number of poles and ampere ratings indicated on the schedule or drawings. Incorporate inverse time characteristic by bi-metallic overload elements and an instantaneous characteristic by magnetic trip.

B. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.

D. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breakers shall be clearly marked ON and OFF.

E. Circuit breakers shall be factory sealed.

F. All circuit breakers shall be suitable for mounting in any position.

G. Circuit breakers shall be equipped with factory installed mechanical lugs.

H. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.

I. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true rms sensing and thermally responsive to protect circuit conductor(s) in a 40° C ambient temperature.

J. For 2-pole and 3-pole breakers, use the common-trip type so that an overload or fault on one pole will trip all poles simultaneously. Handle ties are not acceptable except where multiple single breakers are used to serve modular furniture.

K. Where indicated, provide ground fault (GFCB) or shunt trip breakers.

2.08 LISTING

A. The completed panelboard shall be UL listed.

B. Certification standards, with applicable voltage systems and corresponding interrupting ratings, shall be clearly marked on the face of each circuit breaker.

C. Circuit breakers shall be equipped with listed electrical accessories as noted on the schedules or drawing.

D. When required, circuit breakers shall be listed as HACR type.

E. When required, circuit breakers shall be listed as Switch Duty type.

F. When required or indicated on the drawings or schedules, equipment shall be listed for the environment in which it is installed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install box, trim and interior rigid and plumb. Center interior with opening.

B. Install panelboards in accordance with the instructions of the manufacturer and as shown on the Drawing. Install complete with all required electrical connections.

C. Unless otherwise noted, install panelboards with the top of the trim 6 ft. 0 in. above finished floor.

D. Field check panelboard loading and reconnect circuits as required to provide balanced phase and line loads.

E. Neatly bundle, route and support cables installed in wiring gutters of panelboards. Minimum bending radii as recommended by the wire and cable manufacturer.

F. Install five (5) 3/4” conduits from top of flush mounted panelboards to accessible void above ceiling. Cap end of conduits above ceiling.

G. All recessed panels are to be installed in 6” minimum wall thickness. Coordinate clear dimensions with Architect and General Contractor prior to rough-in.

H. Provide wood trim for any semi-recessed panels, including panelboards. Coordinate with General Contractor and verify finishes with the Owner/Architect.

I. Install filler blanks for any unused breaker space.

J. All panel interior to be free of debris and dirt prior to installing panel covers.

K. Check bolted and circuit breaker connections using a torque wrench.

L. The faces of all circuit breakers shall be flush with each other.

M. Affix permanent and individual circuit numbers to each circuit breaker in a uniform position.

END OF SECTION

SECTION 26 27 26 - DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide switches and receptacles as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

A. Provide all receptacles which conform with NEMA standards for amperage and voltage classification.

B. Provide devices U.L. listed for the application and for the type of wire used.

1.03 ACCEPTABLE MANUFACTURERS

A. Leviton, or approved equal

1.04 SUBMITTALS

A. Furnish Engineer shop submittal for each device.

B. Provide shop submittals which include the following information:

1. Manufacturer and catalog number.

2. NEMA configuration.

3. Voltage and amperage ratings.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Straight Blade Receptacles: Furnish Leviton receptacles or approved equal, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).

1. Single receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.

2. Single receptacle, 20 amp, 250-volt, 2-pole, 3-wire, grounding, NEMA 6-20R.

3. Duplex receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.

4. Tamper resistant, duplex receptacle, 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.

B. Toggle Switches: Furnish Leviton switches or approved equal, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).

1. Single pole, single throw, 20 amp, 120/277 volt.

2. Single pole, double throw, momentary, 20 amp, 120/277 volt.

3. Single pole, double throw, maintained, 20 amp, 120/277 volt.

4. Double pole, single throw, 20 amp, 120/277 volt.

5. Three way, single throw, 20 amp, 120/277 volt.

6. Four way, single throw, 20 amp, 120/277 volt.

C. Locking Switches: Furnish Leviton switches with #55500 key, color shall be White. (Devices and coverplates connected to emergency circuits shall be red).

1. Single pole, single throw, 20 amp, 120/277 volt.

2. Single pole, double throw, momentary, 20 amp, 120/277 volt.

3. Single pole, double throw, maintained, 20 amp, 120/277 volt.

4. Double pole, single throw, 20 amp, 120/277 volt.

5. Three way, single throw, 20 amp, 120/277 volt.

6. Four way, single throw, 20 amp, 120/277 volt.

D. NLight Lighting Control Devices: Provide white devices as standard. **(Devices on emergency circuits to have red plates and white devices).**

E. Dimmer Switches: Furnish Lutron NT series, or equivalent, continuously adjustable slide dimmer with preset on/off switch. Dimmer shall be solid-state type for use with 120-volt incandescent lamps and shall have electromagnetic filters to eliminate noise, RF and TV interference. Dimmer wattage is indicated on the drawings or 1000 watt minimum.

F. Ground Fault Devices: Color shall be White. (Devices and coverplates connected to emergency circuits shall be red).

1. Ground fault circuit interrupter (GFCI), 20 amp, 125-volt, 2-pole, 3-wire, grounding, NEMA 5-20R.

2. Ground fault feed through switch, 20 amp, 125-volt.

G. Device Plates:

1. Unless otherwise indicated, provide smooth metal device plates of Type 430 stainless steel for all indoor devices. Verify color with architect prior to ordering. Cover plates for devices served by emergency circuits shall be red.

2. Provide telephone and data outlets with blank metal type 430 stainless steel covers.

3. Provide properly gasketed vertical single lift device plate of aluminum die cast for weatherproof receptacles and/or switches.

H. Floor Outlets:

1. Provide where shown on the drawings, PVC rectangular floor boxes. Coordinate all dimensions for floor boxes with Architect. Contractor shall not scale from drawings.

2. Receptacle floor outlets specified as duplex shall have duplex screw cap coverplates. Telephone and/or data floor outlet boxes to have combination screw cap coverplate.

3. Provide brass carpet flanges for each floor box installed in carpeted areas.

4. Multiple device locations shall incorporate two (2) or three (3) gang outlet box.

I. Provide GFI receptacles within 6 feet of any sink, lavatory, wet area and outdoors. All GFI resets to be located in the same room protected.

J. Provide GFI protection for all receptacles in areas where power hand tools or portable lights are used (shop areas, garages, etc.).

K. Provide GFI protection for all circuits used for heat tracing.

L. Provide a receptacle in all mechanical/electrical rooms.

M. Surge Arresting Receptacles: Where surge arresting receptacles are indicated, provide receptacles meeting Federal Specification WC-596F which are UL listed (UL 1449 and UL 498) with integral surge suppression. Provide with audible surge protection failure alarm and replaceable surge arrester module. Eagle Electric "Super Spec SurgeBloc" or acceptable equal.

N. All 120volt/20amp receptacles in kitchen area to be GFCI protected.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install wiring devices of the type as indicated on drawings. Make up all connections tight and set device plumb. Use care in installing device in order to prevent damage to the device and the wire in the outlet box.

B. Device Plates: Provide a device plate for each outlet to suit the device installed and install blank plates or covers for junction boxes and empty outlets, including telephone, computer, etc.

C. Mount duplex receptacles vertically with grounding opening **up** unless otherwise noted.

D. Prior to installation of outlets other than 20A, 120 Volts, verify receptacle type with Owner through Architect. Receptacles not verified shall be changed at Electrical Contractor's expense if necessary to operate equipment.

E. Install all switches that are required to be handicap accessible at proper height per latest ADA Standards.

F. Install wall switches vertically in an outlet box on the strike side of the door as finally hung.

G. Install single throw switches so up is the ON position.

H. Locking switches shall be furnished in corridors, common areas and any area with HID lighting. Contractor shall confirm exact location of all locking switches with the Architect/Engineer prior to rough-in.

I. Provide "Caddy Screw Gun Bracket" between wall studs, as required to install switches, thermostats, intercom devices, etc. Verify exact location of devices prior to rough-in. Device boxes shall be aligned on center line of each box.

J. Receptacles installed for electric water coolers shall be mounted at a height so as not to be visible after installation of EWC. Coordinate with equipment being provided.

K. Provide one (1) duplex GFI/weatherproof receptacle within 25 feet of all mechanical equipment, located on the roof, on mezzanines, or on the ground. Connect receptacles to nearest available circuit with not more than 6 receptacles or home run to the nearest available panelboard and provide breaker as required.

L. Engrave coverplates, designated for engraving, with 1/8 inch-high contrasting lettering.

M. Engrave the coverplates of wall switches that control equipment which is not in sight of the switch with the designation of the equipment being controlled. Lettering shall be 1/8 inch high and of a contrasting color.

N. All receptacles located above counter tops with sinks and receptacles in kitchens shall be GFI Type.

O. All receptacles used in Pre-K, Kindergarten and First Grade Classrooms must be safety type receptacles.

P. Provide eighteen (18) additional receptacles in base bid including wire, conduit, breakers and appurtenances. Each receptacle represents a dedicated circuit. Estimate length of circuit is 150 feet. Final location as directed by Architect.

Q. Provide six (6) additional lighting control stations including wire and conduit. Estimated length to circuit is 75 feet. Final location is directed by architect.

R. Provide six (6) additional motion sensors including wire and conduit. Estimated length to circuit is 75 feet. Final location is directed by architect.

S. Provide six (6) additional photo cells including wire and conduit. Estimated length to circuit is 75 feet. Final location is directed by architect.

T. Provide unit price to add additional receptacles over base bid. Use same lengths indicated above.

END OF SECTION

SECTION 26 28 10 - MANUAL MOTOR STARTERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide and install manual motor starters per NEC and as hereinafter specified.

1.02 STANDARD

A. UL Listed.

B. Conform to the latest NEMA Standards.

1.03 ACCEPTABLE MANUFACTURERS

A. Square D

B. Cutler Hammer/Westinghouse

C. ITE Siemens

D. General Electric

1.04 SUBMITTALS

A. Provide data sheets that include equipment voltage/current rating, catalog numbers, horsepower rating and other such descriptive data which may be required.

PART 2 - PRODUCTS

2.01 CONSTRUCTION

A. All manual motor starter switches shall consist of toggle operated two (2) or three (3) pole switches mounted in a NEMA 1 general purpose enclosure unless exposed to outdoor conditions; then mount in NEMA 3R enclosure.

B. Contacts shall be double break silver alloy.

C. Terminals shall be supplied, clearly marked and accessible from front of switch.

D. Switch shall be equipped with melting alloy type thermal overload relay. Thermal unit shall be of one-piece construction and inter-changeable. Starter shall be inoperative if thermal unit is removed.

E. Toggle switch shall be furnished with a handle guard.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Securely mount switches in accordance with NEC and all local codes. Provide all mounting materials and hardware.

B. Confirm with Mechanical and/or Plumbing Contractor prior to mounting switch on respective equipment.

END OF SECTION

SECTION 26 28 15 - SAFETY DISCONNECT SWITCH

PART 1 - GENERAL

1.01 SCOPE OR WORK

A. Provide safety switches for all pieces of equipment per NEC as indicated on the Drawings and specifications or as required.

B. All safety switches are to be FUSED unless noted otherwise.

1.02 STANDARDS

A. Conform to U.L. listed and the latest NEMA standards.

1.03 ACCEPTABLE MANUFACTURERS

A. Square D

B. ITE Siemens

C. Cutler Hammer/Westinghouse

D. General Electric

1.04 SUBMITTALS

A. Furnish Engineer shop submittal for safety disconnect switches.

B. Provide shop submittals which include the following information:

1. NEMA type

2. Enclosure type

3. Ampere rating

PART 2 - PRODUCTS

2.01 CONSTRUCTION

A. Provide safety switches appropriately rated for use with electrical system 600 Vac for 480 volts, 250 Vac for 208 volts and etc.

B. Provide safety switches NEMA Standard KS1 for type HD (heavy duty), and horsepower rated for A/C motors.

C. Switches requiring fuses and rated 600 amps and below shall be provided with rejection clips. Switches rated larger than 600 amps shall have Class “L” fuse connections provided.

D. Provide safety switches in NEMA 1 enclosure located on the interior dry locations. Provide safety switches in NEMA 3R enclosure located on the exterior of the building or in wet locations.

E. Provide quick-make and quick-break operating handle. Provide mechanisms which are an integral part of the box. Furnish a handle suitable for padlocking in the ON and OFF positions with a padlock of 5/16-inch diameter shank.

F. Door Interlock. Furnish a door interlock to prevent opening the door when the switch is in the ON position, unless bypassed, and to prevent turning the switch ON when the door is open.

G. Bypass Interlock. Furnish an external means to bypass the door interlock.

H. Terminal Shield. Furnish incoming line terminals with an insulated shield so that live parts are not exposed when the door is open.

I. Neutral. Where neutrals are indicated furnish switches with an isolated, fully rated neutral block. Make provisions for bonding the block to switch enclosure.

J. Equipment Grounding. Furnish an equipment grounding kit.

K. Fuse Holders. Where fusible switches are indicated, furnish switches with rejection-type fuse holders and fuses conforming to Section 16490, Fuses - 600 Volt and Below.

L. Auxiliary Contacts. Where switches are shown for elevator service, furnish switches with two DPST auxiliary contacts.

M. Provide lugs U.L. listed for copper cable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Securely mount safety switches in accordance with the N.E.C. Provide all mounting materials and mount safety switches vertically.

B. In general, safety switches must be mounted on an independent and separate support system, not on the equipment being served. Where such an independent support would require penetrating or resting on a roof, it is preferable to mount on the equipment. In no case, however, may the switch interfere with access to or operation of the equipment, nor shall the switch be located within the significant impact zone of a flue or other high temperature component. Where screen walls are provided for outdoor units; the top of disconnect shall be below or equal to the top of screen wall.

C. Coordinate final location of disconnect switches to provide a minimum of 36” clear in front of switch. Conduit may not be routed in access clear directly in front of disconnect switch.

D. Install switches for all equipment that requires them. Mount so that operating handle is approximately 60 inches above finished floor. Where grouped, align tops of switches.

E. Disconnects mounted above ceiling must be mounted to be readily accessible near unit. Handle to be no more than 36” above ceiling grid.

F. All exterior disconnects to be mounted below line of sight of a screen wall or if single disconnects, level with top of condenser. Verify location with Architect/Engineer prior to rough-in.

END OF SECTION

SECTION 26 28 16 - FUSES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide and install fuses as shown on the Drawings and as hereinafter specified.

1.02 STANDARDS

A. Conform with the latest requirements of the National Electrical Code, NEMA and be UL listed.

1.03 ACCEPTABLE MANUFACTURERS

A. Bussman

B. Gould

C. Little Fuse

PART 2 - PRODUCTS

2.01 MATERIALS

A. Time Delay/Dual Element (Class R) fuses 1/10 through 600 amps.

B. Time Delay/Dual Element (Class RK5) fuses 1/10 through 200 amps for mechanical equipment and where noted.

C. Time Delay (Class L) fuses 601 - 6000 amps.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Fuses shall not be installed until equipment is ready to be energized.

B. Test and inspection shall be made prior to energization of the equipment. This shall include a thorough cleaning, tightening and review of all electrical connections and inspection of all grounding conductors.

C. All fuses shall be furnished and installed by the Electrical Contractor.

D. All fuses shall be of the same manufacturer.

E. Equipment Fuses: Verify final fuse size with actual equipment being installed. Do not exceed permitted fuse size and voltage of manufacturer ratings.

3.02 INSTALLATION

A. Mains, Feeders and Branch Circuits:

1. Circuit 0 to 600 amperes shall be protected by current limiting dual-element, time delay fuses. All dual-element fuses shall have separate overload and short-circuit elements. The fuse must hold 500% of rated current for a minimum of ten (10) seconds, with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class RK-1 (or RK-5 where

specifically permitted). They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.

2. Circuits 601 to 6000 amperes shall be protected by current limiting time delay fuses. Fuse link shall be pure silver links (99.9%) pure), to limit the short circuit current let through valves to low levels and comply with NEC Sections requiring component protection. Fuses shall be time-delay and must hold 500% of rated current for a minimum of four (4) seconds with an interrupting rating of 200,000 amperes r.m.s. symmetrical. The fuses shall be UL Class L. "CAUTION" labels to alert the end user of engineered level of protection of the electrical equipment, shall be field installed by the Electrical Contractor. They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.

3. Motor Circuits - All individual motors rated for 200 horsepower or less shall be protected by time delay/dual-element fuses. The fuses for motors shall be installed in ratings approximately 125% of motor full load current, except where high ambient temperatures prevail, or where the motor drives a heavy revolving part which cannot be brought up to a full speed quickly, such as large fans. Motors shall be protected by fuses of the rating shown on the Drawings. The fuses shall be UL Class RK-1 (or RK-5 where specifically permitted) Dual Element/Time Delay. "CAUTION" labels to alert the end user of the engineered level of protection of the electrical equipment shall be field installed by the Electrical Contractor. They shall be marked with the proper fuse rating, per the specifications, and placed in a conspicuous location on the enclosure.

B. Spares:

1. Upon completion of the building, the Contractor shall provide the Owner with spare fuses in cabinet as identified in Specification Section 26 05 00.

END OF SECTION

SECTION 26 28 25 - CONTACTORS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide lighting contactors as shown on the drawings and as hereinafter specified.

1.02 STANDARDS

A. Approved per UL 508 and designed in accordance with NFPA 1C52-211B.

B. UL listed.

C. Conform to the latest NEMA Standards.

1.03 ACCEPTABLE MANUFACTURERS

A. Square D

B. ITE Siemens

C. Cutler Hammer/Westinghouse

D. General Electric

1.04 SUBMITTALS

A. Furnish Engineer shop submittals for contactors.

B. Provide shop submittal which includes the following information:

1. Voltage and ampere rating

2. Wiring diagram

3. Enclosure type

4. Coil voltage

PART 2 - PRODUCTS

2.01 GENERAL

A. Continuously current rated.

B. Capable of making and breaking all cases of loads without the aid of auxiliary arcing contacts. Auxiliary arcing contacts are not acceptable.

C. Industrial duty rated for applications to 600 volts maximum.

2.02 MATERIALS

A. Totally closed, double break, silver to silver power contacts. Contact inspection and replacement shall be possible without disturbing line or load wiring.

B. Provide terminals with straight through wiring and accept copper wire.

C. Provide switches or provisions for switches as indicated on the drawings.

D. Unless otherwise indicated, provide contactor in NEMA Type 1 enclosure.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Securely mount lighting contactor. Provide all mounting hardware.

END OF SECTION

SECTION 26 43 00 - SURGE PROTECTIVE DEVICES (SPDs)

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

PART 2 - PRODUCTS

2.01 SURGE PROTECTIVE DEVICES (SPDs)

A. SPD shall be UL 1449 labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.

B. SPD shall be UL 1449 labeled as Type 1 intended for use without need for external or supplemental overcurrent controls. Every suppression component of every mode, including N-G, shall be protected by internal overcurrent and thermal overtemperature controls. SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

C. SPD shall be UL 1449 labeled with 20kA I-nominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

D. Standard 7 Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

E. True 10 Mode Protection paths: SPD shall provide “directly connected protection elements” between all possible modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

F. Maintenance: Provide SPDs with a serviceable replaceable module, with indicator lights for normal and faulted conditions. Provide audible alarm and visual status indicators to indicate need for renewal or replacement. Provide units which are UL listed for installation in accessible areas.

G. Disconnecting Means: If a dedicated breaker for the SPD is not provided in the switchboard, the service entrance SPD shall include an integral UL Recognized disconnect switch. A dedicated breaker shall serve as a means of disconnect for distribution SPD’s.

H. The following styles are defined for determining ratings, installation method, and applications.

1. Service Entrance - SPD shall be exterior to panelboard enclosure, enclosure suitable for same environment as panelboard enclosure, connected to buss through instrument power type of disconnect and protection. Meet UL 1449 4th edition performance parameters. SPD shall be Type 1.

2. Distribution / Branch Panels - SPD shall be exterior to panelboard enclosure, enclosure suitable for same environment as panelboard enclosure, connected through branch circuit breaker in panelboard. Meet UL 1449 4th edition performance parameters. SPD shall be Type 1.

I. Voltage Protection Ratings : For the applicable voltage configuration the SPDs UL 1449 4th edtion Voltage Protection Rating (VPR) in any mode (L-N, L-G, and N_G), shall not exceed the following:

Voltage Configuration	UL 1449 4th Edtion VPR Standard or 10-Mode
120 Volt, 1 Phase	700
120/240 Volt, 1 Phase	700
120/208 Volt, 3 Phase Wye	700
240 Volt, 1 Phase	1000
240 Volt, 3 Phase Delta	1000
277/480 Volt, 3 Phase Wye	1000
480 Volt, 3 Phase Delta	1800

J. SPD shall meet or exceed the following criteria:

1. Surge current rating shall be as defined on the plans.

2. Life Cycle Performance Test: SPD shall be tested and pass a minimum of 17,000 repetitive surge current hits per IEEE C62.41.2 C3 combination waveform with no more than 10% degradation.

3. 471SEL Selection Requirement: When the #471SEL SPD unit is selected, the following over voltage protection requirements must be met.

- SPD shall be able to prevent common temporary over voltages from damaging the MOVs, increasing longevity and ability of SPD unit to protect the critical load. SPD shall limit the voltage per the following chart:

Overvoltage seen by MOVs as % of Nominal				
	available current			
time	30A	100A	500A	1000A
1 cycle	120%	130%	150%	160%
10 cycles	130%	150%	160%	160%
30 cycles	140%	150%	160%	160%

- Temporary Over Voltages: SPD shall be able to withstand a minimum of 100 temporary over voltage events, as defined by: 30A available fault current, 30 cycles of duration, with 10 seconds between events.

K. Available Manufacturers: Subject to compliance with requirements, manufacturers offering SPDs which may be incorporated in the work included, but are not limited to the following:

1. Basis of Design: ACT Communications

2. Alt. Manufacture: All substitutions must get prior approval submit as an Alternate with 3rd party test to verify performance matches specification. Performance cannot be reduced to be considered an alternate.

3. Substitutions not following substitution requirements outlined in general electrical section and criteria outlined in this section will not be considered.

L. Warranty: Manufacturer agrees to repair or replace SPDs that have been started up and inspected per 3.02.A which fail in materials or workmanship within specified warranty period.

1. Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 3 - EXECUTION

3.01 INSTALLATION OF SURGE PROTECTIVE DEVICES (SPDs)

A. General: Install surge arrestors where indicated. Follow the manufacturer's instruction and NEC Article 285 for installation on line or load side of services.

B. Limit the length of tap conductors to the least length practicable. In no case extend unprotected tap conductors more than ten (10) feet, or beyond the enclosure of the panelboard, switchboard or disconnect served.

C. Upon completion of installation, provide the start-up and testing services of a factory-authorized and factory-trained local service representative. A member of the engineer's office or a representative of SWMCO, (512-277-0266), shall be required for performing and witnessing of the tests. The tests shall include:

1. Off-line Testing: Impulse injection to verify the system tolerances as well as verification of proper facility neutral-to-ground bond. Compare field test results to factory benchmark test parameters supplied with each individual unit.

2. On-line Testing: Verify that suppression and filtering paths are operating with 100% protection as well as verification of proper facility neutral-to-ground bond by measuring neutral-to-ground current and voltage and by visual inspection.

3. Voltage measurements from Line-to-Ground (L-G), Line-to-Neutral (L-N), Line-to-Line (L-L), and Neutral-to-Ground (N-G), taken at the time of the testing procedure.

3.02 DOCUMENTATION AND REPORTING

A. Record results of field testing and compare to factory benchmark test parameters supplied with each individual surge protective device. Indicate that the integrity of neutral-to-ground bonds were verified through testing and visual inspection, and that grounding bonds were observed to be in place.

B. Submit to the Owner's representative and to the Architect/Engineer copies of the startup test results and the factory benchmark testing results for confirmation of proper suppression filter system function, as required by this section. Provide the number of copies as required by Division One and the Electrical General Provisions section; and three copies where not otherwise specified.

Surge Protection: PROJECT NAME _____

(Manufacturer to fill out entire form)

1. Surge Manufacturer Name: _____

2. Model Numbers for:
   a. "MSB":
      Model: _____
   b. Panel s _____:
      Model: _____
   b. Panel s _____:
      Model: _____

3. Does MSB Surge have Advance Monitoring _____ Yes _____ No
   (Advanced Monitoring: Voltmeter, Surge Counter, Event Logger)
   Attached specification sheet on monitor _____ Yes _____ No

4. Does MSB have Over-Voltage Protection _____ Yes _____ No

5. Surge ratings:
   a. Model _____ Rating _____
   b. Model _____ Rating _____
   c. Model _____ Rating _____

6. Testing
   a. Have units been tested for Surge Impulse Surge Current by a third party independent laboratory? _____ Yes _____ No
   b. Attached 3rd party Test Report _____ Yes _____ No
   c. Can SPD be tested in field and compared to factory test _____ Yes ___ No

7. Warranty Period
   a. Standard Warranty _____ Years
   b. Life Expectancy _____ Years

END OF SECTION

SECTION 26 51 00 - INTERIOR LIGHTING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all lighting fixtures and equipment as specified in the fixture schedule. Include all necessary accessories and appurtenances required for a complete and operating system whether or not specifically shown.

1.02 STANDARD

A. Provide all materials and accessories, whether specifically described or not, of the best grade of the commercial manufacturer. Provide first class workmanship in every respect.

B. Provide all lighting fixtures with Underwriters' label and manufacturer's label. Attachment of U.L. labels after delivery of fixtures is not acceptable.

C. Manufacture all lighting fixtures in accordance with the National Electrical Code.

D. Ballasts:

1. Provide ballasts for fluorescent lamps which meet U.L. specifications for Class P listing, applicable ANSI Standard Ballast Specifications, and certified by C.B.M. **Maximum - 2 lamps per ballast.**

2. Provide ballasts for HID lamps which comply with the UL Standard for High-Intensity Discharge Lamp Ballasts.

E. Provide lamps manufactured by North American Phillips or Sylvania. Unless otherwise indicated, lamp designations shown on the fixture schedule are Sylvania. (3500K)

1.03 ACCEPTABLE LIGHTING PACKAGES:

A. Lithonia

B. Thomas Daybrite

C. Hubbell

D. Others Fixtures as Scheduled or Noted

1.04 SUBMITTALS

A. Furnish Engineer shop drawings for each fixture.

B. Provide shop drawing which includes the following information:

1. Fixture type per the fixture schedule.

2. Manufacturer of the fixture.

3. Physical dimensions of the fixture.

4. Manufacturer's standard finish.

5. Fixture output distribution curves with utilization parameters.

6. Ballast temperature rating, voltage, wattage, and manufacturer.

7. Material type and thickness of lens.

8. Accessories for installation such as swivel hangers.

9. Number and type of lamps.

C. Submit point-by-point lighting calculations for areas as required by the specifications or noted on the drawings. The calculations shall include lamp lumen depreciation, luminaire dirt depreciation, ballast factor, lamp tilt factors, and initial lamp lumens. The calculations shall indicate maintained horizontal footcandle levels at a height of thirty inches above the floor. In interior spaces the maximum point spacing shall be five feet on center; for outdoor applications the maximum point spacing shall be 30 feet on center unless otherwise noted on the drawings.

D. Lighting Control Submittal

- Shop Drawing Floorplan drawings at 1/8” scale showing
    - motion sensor layout as directed on plans
    - daylight sensor layout as directed on plans
    - identify enabled fixtures
    - identify power packs
    - identify power pack location for open ceiling areas (above panel in electrical room)
- symbol legend identifying symbols
- control sequences
- riser diagrams showing low voltage cabling requirements
- cutsheets all parts

1.05 PRODUCTS STORAGE AND HANDLING

Protect fixtures delivered to the job site from the entrance of water and dust at all times. Replace fixtures damaged by improper handling or storage.

1.06 COORDINATION

A. Catalog numbers shown on the light fixture schedule may not include or adequately represent all the options and accessories required herein, this contractor shall conform to these specifications in their entirety.

B. The various ceiling types are indicated on the architectural plans and in the room finish schedules. All lighting fixtures shall be coordinated with the architectural requirements to insure that the proper trim kit, and/or mounting accessory is provided with each fixture for the intended application. All trim kits and accessories shall be provided by Contractor whether or not they are specifically indicated by the manufacturer’s catalog numbers on the lighting fixture schedule.

C. The locations of all lighting fixtures are approximate. Locations are subject to modifications at the time of installation in order to meet field conditions. Make such changes without extra charge; however, obtain approval from Engineer before any work is started which involves such modifications.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide all fixtures as called for in the schedules, complete with lamps.

B. Provide manufacturer's standard finish unless otherwise noted.

C. Design all recessed or semi-recessed fixtures compatible with ceilings as installed. Provide frames where required for proper installation.

D. Furnish complete, all fixtures requiring end caps, mounting spacers or other necessary items whether the catalog number shown includes such items or not.

E. Conceal all fixture parts within the fixture construction.

F. Self locking lenses/latches are not acceptable.

G. Lighting fixture construction shall effectively eliminate light leaks between the frame, lens, housing and the interior finish surface. Furnish one lens hold-down clip at two foot centers.

H. Linear fluorescent lampholders shall be turn type, medium base, bi-pin, 660 watt, 600 volt.

I. Conceal all fixture parts, including emergency components, within the fixture construction.

J. Fixture construction shall allow parts and lens to be replaced without special tooling.

K. Fixture shall be provided with disconnecting means per NEC 2008.

2.02 FLUORESCENT LIGHTING FIXTURES

A. Grid troffers (lay-ins) must conform to the following:

1. Steel housing with T-bar clips.

2. Flush steel door frame with metal rotary action latches. Door latches or hinges from either side.

3. Diffusers (lens) shall be flat, UV stabilized, acrylic, # 12 pattern a with minimum thickness of 0.095 inches.

B. Wet location troffers must conform to the following:

1. Steel housing.

2. Flush aluminum door frame with metal rotary action latches.

a. Door latches or hinges from either side.

b. Neoprene gasketing between the lens, doorframe, housing and mounting surface.

3. Diffusers (lens) shall be flat, UV stabilized, acrylic, # 12 pattern with internal prisms and a minimum thickness of 0.125 inches.

C. Surface or stem mounted fixtures with a lens must conform to the following:

1. Steel housing.

2. Flush steel door frame with metal rotary action latches.

3. Diffusers (lens) shall be flat, UV stabilized, acrylic, # 12 pattern with a minimum thickness of 0.095 inches.

D. Strip lights must conform to the following:

1. Steel, heavy duty construction.

2. 4 foot lamp lengths. Tandem, double length units are acceptable.

3. Lampholder are secured by a screwed-on end plate.

4. 4 foot wireguards. Tandem units require 2.

2.03 COMPACT FLUORESCENT LIGHTING FIXTURES

A. Compact fluorescent downlights must conform to the following:

1. Galvanized steel frame with adjustable hangers.

2. Outdoor and wet area fixtures shall be lensed, gasketed and listed for wet locations. Only lenses which are flat shall be provided.

3. Electronic ballast if available.

2.04 FLUORESCENT BALLAST

A. Ballast which are located outdoors and in un-heated indoor areas shall be rated for reliable starting to 0 degree F.

B. All fluorescent ballasts must conform to the following:

1. Thermally protected Class P with auto restart circuitry.

2. Class “A” sound rating.

3. Power factor equal to or greater than 90.

4. Contain no PCBs or asbestos.

5. Certification Ballast Manufacturers (CBM) approved.

6. Provide Quick Disconnect (QD) option for quick disconnecting of all ballasts.

C. Linear fluorescent ballast must conform to the following:

1. Fixtures with three or more lamps shall have two ballasts to accommodate dual level switching. Provide 1 or 2 lamp ballasts. Do not use 3 and 4 lamp ballasts. All ballast are to be installed within the fixture of the lamps served.

2. Electronic, instant-start and parallel-connected.

3. Enclosed in a metal enclosure.

4. Provided with integral, color coded leads.

5. Operate at a frequency of 20kHZ or greater with less than 3% visible lamp flicker.

6. Input current total harmonic distortion (THD) shall not exceed 10%.

7. Lamp current crest factor (ratio of peak to RMS current) shall be 1.7 or less.

8. Operate from a 60 Hz input source of 120 or 277 volts and sustain variations of ± 10% (Voltage & Frequency) with no damage to the ballasts.

9. Provide transient immunity.

10. Allow remaining lamp(s) to maintain full light output if one or more lamps fail.

11. Tolerate sustained open circuit and short circuit output conditions without damage.

12. Tolerate operation of up to 65 deg. C. case temperature without damage.

13. Comply with the Federal Communication Commission Rules and Regulations for electromagnetic/radio frequency interference (EMI/RFI), for non-consumer equipment (class A).

D. Compact fluorescent ballast must conform to the following:

1. Operate at a frequency of 20kHZ or greater with less than 3% visible lamp flicker.

2. Input current total harmonic distortion (THD) shall not exceed 20%.

3. Lamp current crest factor (ratio of peak to RMS current) shall be 1.7 or less.

4. Operate from a 60 Hz input source of 120 or 277 volts and sustain variations of ± 10% (Voltage & Frequency) with no damage to the ballasts.

5. Provide transient immunity.

6. Tolerate sustained open circuit and short circuit output conditions without damage.

7. Comply with the Federal Communication Commission Rules and Regulations for electromagnetic/radio frequency interference (EMI/RFI), for non-consumer equipment (class A).

2.05 FLUORESCENT POWER PACKS

A. Where indicated, furnish a system consisting of a sealed rechargeable maintenance-free nickel cadmium battery, battery charger, solid state inverter, test switch, and pilot light.

B. Fluorescent power packs must conform to the following:

1. Suitable for use in both normal and emergency operational modes.

2. Compatible with magnetic and electronic, instant start, 4 foot T8 lamps.

3. Produce 1000 to 1400 lumens initial emergency light output.

4. Operate one lamp in each fixture for a minimum of 90 minutes.

5. Steel housing, approx. 9 3/8” long, mounted concealed within the ballast channel.

6. Test switch and pilot light mounted on the ballast channel cover.

C. Label emergency lighting power packs, using a black marking pen, with the identity of the un-switched circuit.

2.06 EMERGENCY EXIT LIGHTS

A. Exit lights must conform to the following:

1. Furnish a system consisting of a sealed rechargeable maintenance-free nickel cadmium battery, battery charger, solid state inverter, test switch, and pilot light.

2. Meet or exceed the current NFPA requirements.

3. Light emitting diode (LED) type.

4. Die-cast aluminum.

5. Concealed and removable directional chevron knock-outs.

6. Stencil face.

7. Red letter color.

B. Label power packs, using a black marking pen, with the identity of the un-switched circuit.

2.07 METAL HALIDE FIXTURES

A. Metal halide downlights must conform to the following:

1. Galvanized steel frame with adjustable hangers.

2. Outdoor and wet area fixtures shall have flat tempered glass lens with gaskets.

3. Porcelain lamp socket of copper alloy with nickel plated screws, shell and center contact.

B. High and low bay light fixtures must conform to the following:

1. Die-cast aluminum housing.

2. Pendant splice box which allows the fixture housing to slide on.

3. Enclosed glass reflector for high bay

4. Enclosed acrylic reflector for low bay.

5. Porcelain, mogul lamp socket of copper alloy with nickel plated screws, shell and center contact.

6. Full wire-guard, 2 piece, to protect the lens and the reflector.

7. Safety chain.

8. Outdoor and wet area fixtures shall have gaskets.

C. Recessed squares (2 X 2, T-bar and non-T-bar mounted) must conform to the following:

1. Steel housing.

2. Earthquake clips.

3. Flush steel door frame with metal rotary action latches.

4. Flat tempered prismatic glass lens.

5. Porcelain lamp socket of copper alloy with nickel plated screws, shell and center contact.

2.08 HIGH INTENSITY DISCHARGE BALLAST

A. All metal halide ballasts must conform to the following:

1. Field replaceable without the need of special tools.

2. Core and coil, lag type, high reactance, autotransformer, high power factor ballasts for 50-150 watt ballast.

3. Core and coil, constant wattage, autotransformer, high power factor ballasts for 175-1500 watt ballast.

4. All ballast must conform with 'Energy Independence and Security Act 2007'.

B. Library ballast shall achieve an "A" sound rating.

2.09 LAMPS

A. Incandescent lamps shall be rated at 130 volt and have medium, screw, brass bases.

B. Linear and compact fluorescent lamps shall have a color rendering index (CRI) of 80 or greater and a color temperature of 3500 Kelvins.

C. Mogul base HID lamps are preferred over medium bases.

2.10 LED LIGHT FIXTURE

A. Power supplies must use Constant Current Reduction (CCR) for dimming.

B. LED lamps shall have a color rendering index (CRI) of 80 or greater and a color temperature of 3500 Kelvins for interior fixtures and 4100 Kelvins for exterior fixtures or as specified on drawings.

C. Lamp life of minimum of 60,000 hours or as specified.

D. Fixtures must be supplied with multiple power supplies for multi-level switching when specified.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set luminaries true, free of light leaks, warps, dents or other irregularities. Provide the length of stems as required to hang all luminaries level and in the same plane. **VERIFY THE TYPE OF ALL CEILINGS BEFORE ORDERING FIXTURES, AND PROVIDE FIXTURES AND MOUNTINGS TO SUIT.** Mount all fixtures at a position and height to clear equipment, ductwork, piping, etc., in mechanical rooms, storage rooms, etc. Provide appurtenances for all light fixtures, which include stud supports, stems, mounting brackets, frames and plaster rings.

B. Support luminaries only from structural elements which are capable of carrying the total weight. Mount all lighting fixtures rigid with no rocking action. Provide 13/16" channels as needed.

C. The locations of all lighting fixtures as shown are approximate. It is understood that they are subject to such modifications as may be found necessary or desirable at the time of installation in order to meet field conditions. Make such changes without extra charge; however, obtain approval from Engineer before any work is started which involves such modifications.

D. Install ballasts and fixtures in accordance with the NEC and ANSI Standards.

E. Adjust all floodlights and spotlights to the satisfaction of the Engineer.

F. Connect all exit lighting fixtures to the nearest unswitched circuit or the nearest emergency circuit. Connect all emergency lighting fixtures to same circuit as normal area lighting in same area per NEC Article 700

G. Provide and install necessary hardware and accessories to maintain 1.5 inches clearance from combustible material on all light fixtures with ballast.

H. Provide all exit signs with required directional arrows, to indicate direction of egress travel.

I. Fixtures shall <u>NOT</u> be daisy chained together.

J. Troffer (lay-in) lighting fixtures shall be supported from the building structure by a minimum 12 gage galvanized carbon steel soft temper hanger wires. Install two hangers at diagonally opposite corners of each lay-in light fixture 2'x4' or smaller and one hanger at each corner of each lay-in light fixture larger than 2'x4'. Supporting of light fixtures from ceiling system is not acceptable.

K. Each recessed lighting fixture shall be separately connected to a junction box with a flexible wiring method (i.e. daisy chaining from fixture to fixture is not allowed). The flexible conduit from the junction box to the fixture shall not lay on the ceiling as finally installed and shall not exceed 6 feet in length.

L. Boxes to which light fixtures or pendants are mounted shall NOT contain any conductors foreign to the operation of such light or pendant application. Removal of lights, pendants and cord drops to access other branch circuits is NOT acceptable.

M. Pendant mounted light fixtures shall be provided with ¾", threaded, rigid metal conduit, painted to match the fixture color.

N. Install flush mounted fixtures properly to eliminate light leakage between fixture frame and finished surface, provide gaskets as needed.

O. Install high or low bay light fixtures between the joist with the bottom of the reflector flush with the bottom cord of the joist. Engineer will direct if obstructions such as ducts, beams, etc. are permanently installed below the joist.

P. Locate mechanical, electrical, equipment, etc. room light fixtures to provide the best coverage and clear all obstructions such as ducts, piping, bracing and supports.

Q. Fluorescent High Bay are to be rigidly mounted with all thread, ¾" threaded rigid metal conduit and unistrut as required.

3.02 CLEAN UP

A. Leave all fixtures in clean condition, free of dirt and defects.

END OF SECTION

SECTION 26 56 00 - EXTERIOR LIGHTING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all exterior lighting fixtures and equipment as specified in the fixture schedule. Include all necessary accessories and appurtenances required for a complete and operating system whether or not specifically shown. Exterior lights shall be circuited through lighting contactor for time clock/photocell control.

1.02 STANDARDS

A. Provide all materials and accessories, whether specifically described or not, of the best grade of commercial manufacturer. Provide first class workmanship in every respect.

B. Provide all lighting fixtures with Underwriters' label and manufacturer's label. Attachment of U.L. labels after delivery of fixtures will not be acceptable.

C. Manufacture lighting fixtures in accordance with the National Electrical Code.

D. Provide lamps manufactured by North American Phillips or Sylvania. Unless otherwise indicated, lamp designations shown on the fixture schedule are Sylvania.

1.03 ACCEPTABLE LIGHTING PACKAGES:

A. Lithonia

B. Thomas Daybrite

C. Hubbell

D. Others as scheduled or noted

1.04 SUBMITTALS

A. Furnish Engineer shop drawings for each fixture.

B. Provide shop drawing which includes the following information:

1. Fixture type per the fixture schedule
2. Manufacturer of the fixture
3. Physical dimensions of the fixture
4. Manufacturer's standard finish
5. Lamp type recommended by the manufacturer
6. Fixture output distribution curves and photometrics
7. Ballast temperature rating, voltage, wattage, and manufacturer
8. Material type of lens

C. Furnish structural engineer with approved shop drawings on pole, post and Bollard light fixtures for purpose of designing fixture base.

1.05 PRODUCT STORAGE AND HANDLING

Protect fixtures delivered to the job site from the entrance of water and dust at all times. Replace fixtures damaged by improper handling or storage.

PART 2 - PRODUCTS

2.01 GENERAL

A. Provide luminaire complete with the fixture housing, refractor, lamp, and ballast.

B. Provide type, wattage, and voltage lamp designated on Drawings.

C. Where indicated on Drawings, provide parking lot poles and floodlight poles.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Orient lighting fixtures as shown on Drawings.

B. Adjust all floodlights and spotlights to the satisfaction of the Engineer.

C. Coordinate exact location of lighting fixtures with Architect prior to rough-in.

3.02 CLEAN UP

A. Leave all fixtures and poles in clean condition, free of dirt and defects.

END OF SECTION

SECTION 28 31 00 – FIRE ALARM & DETECTION SYSTEM

PART 1-GENERAL

1.01 SCOPE OF WORK

A. SPECIAL NOTE: All provisions and divisions of these specifications are a part of this section of these specifications. The Contractor shall consult these divisions and provisions in detail for instructions and include all items pertaining to this work. The Contractor shall consult all other divisions of these specifications, determine the extent of impact on the work required to complete the work required by this section of the specifications or portion thereof and related work shown on the drawings.

B. SYSTEM DESCRIPTION (SCHOOL): The Contractor shall provide all equipment, materials, tools, labor, engineering, drawings, testing, and certifications necessary for a complete operational, code compliant, addressable/voice evacuation fire alarm system for the remodeled portion of the Elementary School building and the new Career Center addition for the High School. Elementary School shall connect to the existing system. New Career Center shall connect to the existing High School System. Expand existing systems as required. The purpose of the contract documents is to convey to the Contractor the scope of work required, for which the Contractor is responsible to furnish, install, adjust and make ready for operation.

1. New and existing buildings.

2. Remove all existing fire alarm wiring and devices in remodel area.

3. Contractor may reuse existing conduit and boxes if in correct locations, and if they are compatible with new devices, otherwise provide new.

4. Coordinate timing of system replacement with Owner.

5. Complete Building

C. SPECIAL NOTE:
Cad Drawings:
Architectural Background Files – **Architectural Files are background files, MEP drawings are not background files.** To insure the most current Architectural files are used for shop drawings backgrounds, they must be obtained from the architect and cannot be given from the engineer. Reference Architect for cost of Architectural Files.

Contract Drawings – These drawings cannot be used for shop drawings, as they are diagramatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades.

MEP Drawings – These drawings cannot be used for shop drawings, as they are diagrammatic in nature only. Actual shop drawings prepared by sub-contractors must be used for coordination between all trades. If MEP floorplan files are requested they may be obtained for $200.00 per file and a signed confidentiality release form. These files may be used in conjunction with this project only. There are no guarantees of compatibility or accuracy; all technical support will be billed hourly at current Engineer's Rates. See submittal and shop drawing section for additional information.

D. All major elements of the work are described. The Contractor is expected, to anticipate and include in the cost of the work any incidentals that may be required, but are not specifically expressed, in order to provide a complete and fully functional fire alarm system for this structure.

E. This is a performance specification. Specifications and drawings reflect the intent and scope of the project. The Contractor is expected to make allowances for necessary adjustment during the actual system installation, to examine physical conditions, coordinate the actual device locations as necessary to accommodate the existing conditions, obstructions, manufacturer's installation specifications, applicable codes, and the work of others. No extra payments will be allowed for the Contractor on account of extra work made necessary by his failure to make such allowances. The cost associated with this task shall be included in the Contractor's base bid. Any case of error, omission, discrepancy or lack of clarity shall be promptly identified to the Owner for clarification prior to submission of the base proposal price. **CONSTRUCTION AND INSTALLATION DRAWINGS SHALL BE PREPARED BY A STATE OF TEXAS LICENSED ALARM DESIGNER, NICET 111 OR PE (REGISTERED PROFESSIONAL ENGINEER) IN THE STATE OF TEXAS. FIRE ALARM CONTRACTOR TO BE ACR CERTIFIED.**

1. The Installing Contractor shall be licensed by the Texas Commission on Fire Protection to sell, install and service Elevator Recall Systems as required by Article 5.43-2 of the Texas Insurance Code. Reference Elevator Recall Specification.

F. **Contractor to provide all devices required by code and local authorities and should appear on Fire Alarm Shop drawings.** The Contractor shall provide all devices and equipment as required by these specifications. Deviations from the specified items shall be at the risk of the contractor until the date of final acceptance by the architect, engineer, and owner's representative. All costs for removal, relocation, or replacement of a substituted item shall be at the risk of the contractor.

G. **Fire Alarm Contractor to obtain system approval from Local Fire Marshall. System Planner's Name and License Number are to appear on shop drawings.**

H. Duct detectors on air handlers must be connected to the alarm panel, and the location of the detector must be clearly indicated at the fire alarm panel.

I. Electrical Contractor is to coordinate location of back boxes for exterior devices prior to exterior walls being erected, to insure flush mount devices are installed where specified.

J. For standard rough-in locations of A/V or Visual Devices in most rooms including classrooms reference Detail "Typical Device Location Next to Doors".

K. Reference Mechanical Unit Schedule for additional duct detector requirements and quantity of gas fired Mechanical Equipment which requires Carbon Monoxide (CO) detection.

1.02 PERFORMANCE GUIDELINES

A. This Contractor shall provide labor, materials, equipment, and installation for a functional fire alarm and as outlined in these specifications and shown on the drawings. The Contractor shall be responsible for compliance with the entire project specifications as well as the following guidelines. The guidelines are not intended to be all-inclusive, to limit or define the Contractor's Scope of Work. The work includes the following:

1. Installation of a complete operational point addressable fire alarm system.

2. Core drilling and fire stopping.

3. Cutting, patching and fire caulking. (Keep UL details at site for fire caulk being used.)

4. Detailed shop drawings.

5. Coordinate the work with other trades for this project and coordinate with any other Owner projects in the building ongoing at the time of Fire Alarm Contractor's work.

6. Provide on-site project supervision by a person licensed by the State Fire Marshal while any installation is being performed.

7. Develop a construction schedule, conduct bimonthly job progress meetings, and issue bimonthly written job progress reports to the Owner and Engineer.

8. Provide record documents as required by code, AHJ and specifications.

9. Provide operating and maintenance instructions.

10. Conduct a test of the system upon completion of installation to assure the Contractor and the Owner that the system is operational. This test shall take place prior to the commissioning test.

11. Conduct the commissioning test. The Fire Alarm Contractor shall furnish personnel who are familiar with the installation at a time convenient to the Authority Having Jurisdiction, Owner and Engineer.

12. Provide training of Owner's personnel.

13. Provide design and as built drawings in ACAD *2000* or later DWG format.

14. Provide 1-year job site warranty of all materials and labor furnished under this section. The 1-year warranty shall begin upon Authority Having Jurisdiction, Owner and Engineer acceptance.

15. Provide final approved printed set of fire alarm drawing in main electric room. Put in 4" PVC labeled tube and secure to wall.

B. Devices required but not limited to the following areas:

1. Visual devices in all rooms except single offices, janitor's room and small mechanical rooms.

2. Option 1 - Pull stations at every door to exterior of building maximum 200 ft. between pull stations and on second floor as required by code. Provide Stopper II covers on all pull stations.

2. Option 2 - Provide pull stations as required by code, including but not limited to the following locations: at FACP, fire riser room, cafeteria exits to exterior, main school exit to exterior, gym exits to exterior, library exits to exterior. Review final locations with Owner prior to AHJ review.

3. Audio/Visual devices in all common area toilet rooms and visual device in single fixture restroom.

4. Install Audio/Visuals in corridors spaced to be clearly audible above ambient noise (Maximum 100' o.c. and not more than 15' from the end of a corridor) and as required by local Fire Marshal or authority having jurisdiction.

5. Connect tamper/flow switches for the sprinkler system. Switches provided by Sprinkler Contractor. Coordinate with Sprinkler Contractor for compatibility.

6. Provide twenty percent (20%) excess capacity in the fire alarm panel and on <u>each</u> circuit to allow for future expansion by the owner.

7. Provide rough-in junction boxes for all devices and conduit to above ceiling or accessible area.

8. Smoke detectors in all store rooms, Technology/Data rooms, and any room housing power supplies.

9. Heat detector in all electric and Technology/Data rooms.

10. Provide magnet hold opens and door releases for all fire doors and coiling doors. Reference architectural door schedule and hardware specification for quantity, location and type. Make all required connections.

11. Install smoke or heat detectors at each elevator landing per code and authority having jurisdiction.

12. Install ceiling mounted heat and smoke detectors in Elevator Machine Room.

13. Provide connection to the elevator machine equipment for shutdown, recall and notification of elevators in accordance with ANSI A17.1. The Elevator Recall System Contractor shall provide all equipment, materials, and labor required for the shutdown of elevators if hoistways and or elevator machine room has or is to receive a fire sprinkler head. Heat detectors shall also be added as required.

14. Install exterior device as required by code and plans.

15. Provide fire alarm annunciator panel (FAAP) in reception and fire sprinkler riser rooms.

16. Provide all relays and wiring to elevator controller for Primary Recall, Alternate Recall and Fireman Service.

17. Provide duct smoke detectors in the following areas as required by code and the Local Authority Having Jurisdiction. Install duct smoke detectors in supply and return air of all units OVER 2000 CFM, all units grouped together with common return and combined CFM OVER 2000, all units serving rated egress ways. **REFERENCE MECHANICAL DRAWINGS AND/OR MECHANICAL SCHEDULES FOR ADDITIONAL INFORMATION.** Detectors to be provided by Fire Alarm Contractor, installed by Mechanical Contractor, with final connection by Fire Alarm Contractor. Duct smoke detectors shall be installed inside air mover device where possible. Refer to Mechanical Equipment Schedule for additional information on units. Fire Alarm Contractor to provide, set and connect to relay with shut down contacts inside air mover device control panel, if space prohibits installation of relay inside air mover device control panel, then install relay in an enclosure (Nema 1 or Nema 3R as required) mounted on air mover device. Electrical Contractor shall provide and install control wiring from relay to air mover device controls cabinet. Coil wire in controls cabinet for Mechanical Contractor to make final connection to air mover unit controls. At Fire Alarm Contractor's option, FULL AREA DETECTION may be used in lieu of duct detectors. Provide smoke detectors in any existing units as required, field verify locations.

18. Audio/Visual devices in all classrooms and time out rooms as required.

19. Install ceiling mounted smoke detectors, maximum of 30 feet on center and 15 feet from the end, in all egress corridors.

20. Install heat detectors in kitchen cooking area and smoke detectors in rest of kitchen area.

21. Connection to kitchen hood extinguishing system and connect to kitchen hood fan systems. Hood exhaust fans to run and hood supply fans to not operate on fire alarm suppression system activation.

22. Provide signal to building DDC system to shut down all mechanical equipment that is controlled via the DDC system in the event that the fire alarm is activated. This is a secondary shutdown and it CANNOT take the place of the individual relays in each unit connected directly to the fire alarm in units as required.

23. Provide wireguards in all gyms and multi-purpose rooms where devices could be impacted and broken by room normal activity.

24. Provide visual device directly outside fire sprinkler room.

25. Install wall-mounted speakers in corridors at spacing required for intelligibility.

26. Provide carbon monoxide (CO) detector in all classrooms and all mechanical rooms with gas appliances per IFC 2015,915 and NFPA 720 (rated for commercial). Detector to report locally and back to main fire alarm panel to monitoring station. Must have own zone.

C. Fire Alarm Contractor responsible for all rough-in and providing power for fire alarm panel and power supplies.

1.03 APPLICABLE STANDARDS

A. The following standards and guides (current adopted edition) are hereby made a part of this work by reference there to.

B. National Fire Protection Association (NFPA):

1. NFPA 13 - Installation of Sprinkler Systems,

2. NFPA 20 - Installation of Centrifugal Fire Pumps,

3. NFPA 70 - National Electrical Code,

4. NFPA 72 - National Fire Alarm Code,

5. NFPA 90A - Standard for the Installation of Air-conditioning and Ventilating Systems

6. NFPA 92A - Recommended Practice for Smoke Control Systems

7. NFPA 92B - Guide for Smoke Management Systems in Malls, Atria, and Large Areas

8. NFPA 101 - Life Safety Code

9. NFPA 110 - Emergency and Standby Power Systems

C. Underwriters Laboratories latest edition:

1. UL Standard 346, Waterflow Indicators for Fire Protective Signaling Systems

2. UL Standard 268, Smoke Detectors for Fire Protective Signaling Systems

3. UL Standard 521, Heat Detectors for Fire Protective Signaling Systems

4. UL Standard 827, Central Stations for Watchman, Fire Alarm and Supervisory Services

5. UL Standard 268, Smoke Detectors for Fire Protective Signaling Systems

6. UL Standard 864, Control Units for Fire Protective Signaling Systems

7. UL Standard 1424, Cables for Power-Limited Fire Protective Signaling Systems

8. UL Standard 1480, Speakers for Fire Protective Signaling Systems

9. UL Standard 1481, Power Supplies for Fire Protective Signaling Systems

10. UL Standard 1971, Signaling Devices for the Hearing Impaired

11. UL Standard 1711, Amplifiers for Fire Protective Signaling Systems

D. American National Standards Institute (ANSI) A17, Safety Code for Elevators and Escalators, latest edition.

E. Americans with Disabilities Act Accessibility Guidelines (ADAAG) latest edition.

F. Texas Accessibility Standards (TAS), latest approved edition.

G. International Fire Code (IFC) current edition.

H. International Building Codes (IBC)

I. IEC 60268-16:2011(E) Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission index.

J. ISO 7240-24:2010 Fire detection and fire alarm systems – Part 24: Sound system loud speakers.

K. ANSI 117.1 American National Standard for Accessible and Useable Buildings and Facilities.

L. All requirements of the local Authority Having Jurisdiction (AHJ).

1.04 DEFINITIONS AND ABBREVIATIONS

A. Approved: Unless otherwise stated, materials, equipment or submittals approved by the Owner and Engineer.

B. Authority Having Jurisdiction: Local Fire Department having jurisdiction
Texas Department of Insurance State Fire Marshal's Office

C. Concealed: Where used in connection with installation of piping or conduit and accessories, shall mean, "hidden from sight" as in shafts, furred spaces, in softies, in walls or above suspended ceilings.

D. Contractor: The company awarded the prime contract for this work and any of it's subcontractors, vendors, suppliers or fabricators.

E. Exposed: Where used in connection with installation of conduit and accessories shall mean "visible" or "not concealed".

1.05 RELATED WORK

A. Related work existing or specified in other sections:

1. Electrical

2. Demolition and removal of existing system

B. Existing equipment or equipment furnished and installed by others under another section of the specification to be wired, and connected to the fire alarm system by the fire alarm contractor as required:

1. Fire Smoke dampers are furnished and installed *by* others. The Fire alarm contractor to provide an alarm relay (contacts rated minimum 10 amp) for control.

2. AHU, RTU, HVLS Fan (equipment) shutdown control. Fire alarm Contractor to provide an accessible control relay for equipment control. Fire alarm contractor to provide necessary wire conductors from control relay to equipment connection point. Fire Alarm contractor to provide and install duct smoke detectors.

3. Provide electrical power connections to all fire alarm panels.

4. SPECIAL SYSTEM: Fire suppression system alarm micro-switch provided by others, to be wired and monitored by the fire alarm contractor.

1.06 PERFORMANCE REQUIREMENTS

A. Install a UL listed point addressable fire alarm and supervisory alarm system. Acceptable manufacturers are listed in the Part II - Products section. The new system shall include but, is not limited to, the following as required:

1. Provide devices to properly monitor and supervise the sprinkler system devices. This includes all waterflow devices, all valve supervisory devices, and all devices associated with the fire pump to be installed by the Sprinkler Contractor.

2. Where voice evacuation is required provide shut down of amplified sound system upon alarm.

3. Provide user controls *for* override of smoke control/fan shutdown functions to allow for maintenance and testing to minimize disruption of normal activities, i.e. walk test or service group functions.

4. All initiating devices shall have a unique digital address. Monitor devices for water based fire extinguishing system valve position supervisory switches shall be allowed to have a maximum of five (5) supervisory switches per address provided the valves are located in the same physical area.

5. Where indicated on bid documents the audible portion of the public alarm shall be a voice, evacuation system. Signals generated shall be the distinctive evacuation signal with a digitized textual message. It shall allow for voice paging to selected areas and an all-call control.

6. All system must be listed and approved as a smoke detector sensitivity test set and be capable of providing drift compensation.

7. All systems must be field programmable for all changes, alterations, modifications, additions, deletions and hardware and software upgrades.

8. All systems must be capable of generating comprehensive reports for sensitivity, verification counts and address registers.

B. Systems Circuit Wiring:

1. All fire alarm initiating device circuits (IDC) shall be NFPA 72, Style B, electrically supervised circuits from the point addressable interface modules to the devices.

2. All fire alarm point addressable circuits (SLC) shall be NFPA 72, Style 6, supervised signaling line circuits from the fire alarm panel to the point addressable sensors or point addressable interface modules.

3. All notification appliance circuits (NAC) shall be NFPA, Style Y, supervise notification appliance circuits from the fire alarm panel to the audible devices, and strobes.

1.07 SYSTEM OPERATION

A. The point addressable fire alarm and supervisory system shall perform the following functions:

1. Continuous monitoring of the status of all-new alarm and supervisory signal initiating devices.

2. Continuous monitoring of all new electrically supervised initiating, supervisory, and signaling circuits.

3. Visible point annunciation of all fire alarm point trouble conditions at the control panel.

4. Operation of elevator controls as indicated herein.

5. Be silenced by a code or Firefighter key at the main or remote annunciators

B. Upon change in status of any device on the system, the fire alarm control panel shall activate audible and visible status change indicators and display the system point number, point description and message associated with the point. Permanently record the change in status, time, date, point description, and message in the history buffer, and transmit the point ID information to the central monitoring station.

C. Activation of any smoke detector, heat detector, manual pull station, supervisory device or other initiating device will cause the following functions to occur:

1. Duct type smoke detector operation shall cause the following to occur:

a. Activate audible and visible status changes indicators and display the system point number, point description, and message associated with the point on the system's operator terminal.

b. Permanently record the change in status, time, date, point description, and message associated with the point in history buffer

c. Release electronically held open and or locked doors.

d. Activate smoke control system.

e. Activate the supervisory signal

f. Transmit supervisory condition using point ID to the Owners Central Station, point description, and message associated with the point on the system's operator terminal.

g. Permanently record the change in status, time, date, point description, and message associated with the point in history buffer

h. Activate the audio visual alarm

2. Supervisory device or trouble condition activation, including valve supervisory devices, shall: Activate audible and visible status with the point on the system's operator terminal.

   a. Permanently record the change in status changes indicators and display the system point number, point description, and message associated, time, date, point description, and message associated with the point in history buffer

   b. Transmit supervisory condition using point ID to the Owners Central Station

   c. When the device in trouble is restored to normal, the control panel shall be automatically reset

D. Activation of an auxiliary bypass switch for Elevator Recall System shall override the automatic functions either selectively or throughout the system and initiate a trouble condition at the control panel.

1.08 SUBMITTALS

A. Submit the following equipment information:

1. Manufacturer's data sheets with equipment to be used highlighted

2. Wiring diagrams of all equipment,

3. Installation instructions for all equipment,

4. Equipment dimensions,

5. Equipment testing procedures,

6. Equipment operation and maintenance manuals,

7. Wire data sheets.

B. Submit the following software information:

1. Complete sequence of operation with input/output matrix for all points

C. Submit the following system calculations:

1. Standby battery capacity for fire alarm

2. Standby battery capacity for voice alarm

3. Standby battery capacity for all remote panels

4. Voltage drop calculations for each type of circuit (identifying all mathematical formulas, variables, constants, and sources of the mathematical constants),

5. Speaker zone/circuit loading (including amplifier loading),

6. Strobe zone/circuit loading,

7. Normal 120 VAC fire alarm panel(s) circuit loading,

8. Normal 120 VAC voice alarm panel(s) circuit loading,

9. Normal 120 VAC remote panel circuit loading.

D. Provide the following shop drawing information (Shop drawings shall be prepared using AutoCAD. Shop drawings shall be drawn to scale: 1/8" = 1'0" for floor plans

1. Complete point to point wiring diagrams showing all field terminations.

2. Complete panel layout showing location of all modules, power supplies, batteries, and all field terminations.

3. Complete system riser diagrams, indicating wire sizes and types,

4. Interaction with all other building systems (i.e. elevator, AHU, FSD)

5. Complete floor plans showing all devices with point numbers

6. Main panel elevations

7. ADS drawings.

8. Backgrounds for floor plans to be obtained from Architect not MEP Engineer. Reference Specification Section, "26 05 00 - General, 1.01, L".

E. Submittal packages shall be signed by NICET III or signed and sealed by a PE registered in the State of Texas.

F. Prior to start of construction, submit the information outlined in A, B, C, and D above as follows:

1. Three complete system packages to the Owner for review by the Owner and Engineer.

2. One copy of Authority Having Jurisdiction (AHJ) "Approved Plan"

1.09 PARTIAL SUBMITTALS ARE NOT ACCEPTABLE.

1.10 WARRANTY

A. This Contractor shall provide a one-year written warranty against defects in material and workmanship furnished under this Contract. The costs of such warranty shall be part of the purchase price. The warranty shall commence when the Owner and Engineer accept the system and installation.

B. The warranty shall include all necessary material, travel, labor and parts to replace defective components or materials at the job site. This Contractor shall commence repair of any "in warranty" defects within 8 hours of notification of such defects.

C. The Contractor shall include, as part of the one-year warranty, a test and inspection of the new fire alarm devices within one month prior to the expiration of the one-year construction warranty. The Contractor shall provide a written report of any deficiencies and repair any of the deficiencies. The test and inspection report shall conform to the test and inspection form as described in NFPA 72 and as required by the AHJ.

1.11 UNIT PRICES

A. The Contractor shall provide with his bid, unit price during construction for the items in the following list. The unit prices for the devices shall include the device, installation, 20 feet of conduit, wire, programming and any other required installation.

1. Addressable rate of rise heat detector.

2. Addressable photoelectric smoke detector.
3. Beam smoke detector.
4. Addressable duct smoke detector with relay.
5. Addressable manual pull station.
6. Point addressable monitor module.
7. Point addressable control/relay module.
8. 24 VDC Relay SP/DT, with 10 amp rated contacts
9. Fire Alarm Speaker.
10. Strobe Wall Mount. 15/75, 30, 75, and 110 candela rating
11. Strobe Ceiling Mount. 15/75, 30, 75, and 110 candela rating
12. Speaker/Strobe Wall Mount. 15/75, 30, 75, and 110 candela rating
13. Speaker/Strobe Ceiling Mount. 15/75, 30, 75, and 110 candela rating
14. Horn/Strobe Wall Mount15/75, 30, 75, and 110 candela rating
15. Horn/Strobe Ceiling Mount 15/75, 30, 75, and 110 candela rating
16. Remote 80 character LCD annunciator
17. 5495 Silent Knight power supply
18. 5496 Silent Knight power supply
19. 5895 Silent Knight Smart power supply
20. Stopper II manual pull station cover
21. Carbon Monoxide (CO) detector

1.12 QUALITY ASSURANCE

A. The fire alarm system manufacturer or authorized distributor shall maintain a fully staffed branch office including application engineers, drafters and technical service personnel.

B. All supplied equipment shall be new, currently manufactured, standard product of the manufacturer.

C. All technical service personnel shall be regularly employed by the distributor of the fire alarm system.

D. The installing Contractor shall hold a current license, issued by the State of Texas Commission on Fire Safety, to design, install, and service fire detection and alarm equipment.

E. All electrical installation of the fire alarm system, including wire installation and terminations, shall be performed by personnel employed by the Fire Alarm Contractor.

F. Any subcontractors used to install portions of the system shall be submitted and approved by the Owner and the Engineer prior to commencement of the installation.

1.13 SUBSTANTIAL COMPLETION

A. Substantial completion shall be the date of AHJ inspection.

PART 2 - PRODUCTS

2.00 MAIN FIRE ALARM PARTS INFORMATION

A. Manufacturers:

1. Basebid shall be Silent Knight/Farenhyt (with Emergency Communication System)

B. Control Panel

1. Silent Knight IFP-1000-ECS or 5820 XL-EVS analog addressable control panel with Emergency Communication Systems.

2. Where voice evacuation is required, Contractor shall provide emergency communications at both the FACP and RVEP locations.

3. Provide Fire Communicator – Honeywell 'IPGSM-4G' or equal as approved by local AHJ.

C. Fire Alarm System Devices

1. Analog Photoelectric Smoke detector

2. Analog Heat Sensor (with Relay)

3. Addressable Relay Module

4. Duct Detector Enclosure

5. Addressable Input Module

6. Mini Input Module

7. Addressable Relay Module

8. Addressable Notification Module

9. Two Wire Smoke Detector Module

10. Detector Isolation Base

11. Detector Relay Base

12. Detector Sounder Base

13. Duct Detector Housing

14. Remote Test Switch For Duct Housing

15. Addressable Pull Station (with Stopper ll cover or equal)

16. Beam type Smoke Detector (Fire Ray)

17. Document Box (SRD) confirm location.

18. Voice Evacuation Speaker/Speaker Strobes

19. Carbon Monoxide (CO) detector with sounder base (B2005) powered by UL listed power supplies.

D. Remote Transponder Panels

1. Power Module - #RPS-1000 or 5895XL

E. ADA Emergency Call System

1. ADA 100

F. Approved Installers:

1. JM Electronics

2. Care Specialties

3. Firetrol Protection Systems

4. Skelton Timing Control

5. Vanguard Fire & Security

6. Other approved equals

2.01 MAIN FIRE ALARM PRODUCT DESCRIPTION

A. Manufacturers:

1. Reference 2.00 above.

B. Control Panel

1. The fire alarm control panel (FACP) shall be an intelligent addressable control panel with integrated in-building Emergency Voice Evacuation. The FACP must supervise low battery, loss off AC and loss of communication. The communication protocol on the SLC loop must be digital. Reference 2.00 above.

2. The panel must have a built in 80 character LCD annunciator with the capability of having an additional eight supervised remote annunciators connected in the field.

3. The FACP must have a built in UL approved digital communicator. The communicator must allow local and remote up/downloading of system operating options, event history, and detector sensitivity data.

4. The FACP must automatically test the smoke detectors in compliance with NFPA standards to ensure that they are within listed sensitivity parameters and be listed with Underwriters Laboratories for this purpose.

5. Devices supported must include analog photoelectric, ionization smoke detectors, analog heat detectors, addressable input modules, relay output modules or addressable notification modules. There is to be no limit to the number of any particular device type up to the maximum of 127 that can be connected to the SLC. Devices must be same manufacturer as control panel. Reference 2.00 above.

C. Normal operating power for the FACP shall be 120 volt AC supplied from dedicated circuits. All circuits shall be protected by circuit breakers of proper size.

D. The fire alarm system shall be provided with an emergency standby power system consisting of backup batteries. Batteries shall be sealed lead-acid or gel cell of sufficient capacity to provide 24 hours standby operation plus 15 minutes in full alarm condition. All calculations shall allow a minimum of 20% safety factor for battery degradation.

E. The FACP shall accommodate all specified initiating device, notification appliance and command points. Each initiating circuit shall allow a 25 percent expansion of connected detection devices and 20 percent expansion of connected monitor/control points. Each notification/signaling line circuit shall allow a 20 percent expansion of connected devices.

F. The Fire Alarm Control Panel shall automatically interrogate each intelligent detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is below or above normal limits, the controller shall differentiate between long term drift above the pre-alarm threshold (maintenance alert, indicative of the need for cleaning) and a fast rise above the pre-alarm threshold (indicative of a smoldering fire).

G. The Fire Alarm Control Panel CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

H. Each addressable device on an SLC loop shall systematically report for type identification. Loss of signal from any addressable device shall result in trouble condition indication at the control panel. If the inadvertent installation of another type sensor takes place, the system and the installed device shall operate however, a "WRONG DEVICE" trouble condition will display until the proper unit is installed or the programmed sensor type is changed.

I. The system shall be capable of on-site programming to facilitate changes in operation, sensor sensitivity, or system expansion. The unit shall contain non-volatile EPROM memory; loss of primary and secondary power shall not result in loss of programming information.

J. All system software and firmware shall be UL listed with the control panel and protected from unauthorized changes. The microprocessor shall contain and execute on site programmable logical statements for each control-by-event specific action to be taken when an alarm condition is detected at specific programmed points by the system. Control-by-event equations shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs. Any software or firmware changes made shall require a minimum of a 10% functional test of the system.

K. The digital communicator shall have the basic capability to transmit the status of the following software zones:

Waterflow Fire Alarm (when applicable)
General Fire Alarm
Point Annunciating Alarm by Zone
Supervisory Alarm
Trouble Condition

L. In addition, the digital alarm communicator shall transmit signals indicating: Panel Off-Normal, Signal Trouble, Low Battery, AC Power Failure, and software zone/point identification information for each addressable device that generators an alarm or trouble.

M. The emergency voice/alarm system shall provide high-intelligibility voice signal amplification to drive 25 or 70 VRMS speakers as required. Frequency response of amplifier shall be 400-4000 Hz. Provide as indicated a panel mounted, low impedance, dynamic, push-to-talk microphone. The system shall broadcast a digitally recorded message up to four minutes in length on alarm. The message shall automatically repeat, play alarm tones, and repeat as long as the FACP is in alarm unless the message is overridden by keying message, unless otherwise instructed the message shall be; One round or code-3 temporal horn followed by "Attention, Attention, a fire emergency has been reported. Please leave the building using the nearest exist" or an equivalent standard statement.

N. The amplifier, signal generator, power supply, output transformer, and speaker lines shall be continuously supervised. The FACP shall supervise the activation circuit. Provide circuit overload, overheat, over-voltage, polarity reverse, open/short, and automatic current limiting protection. Provide sufficient battery backup power capacity, from the FACP or a signal power expander, for operation without AC power for twenty-four hours of normal supervision and two hours of emergency operation at the end of the period. Fifteen minutes of evacuation alarm operation at maximum connected load shall be considered the equivalent of two hours of emergency operation; include a 20% safety factor in battery calculations to ensure adequate performance for the service life of batteries. The power supply/changer and batteries shall supply power limited operating and emergency power. The charger shall be capable of maintaining batteries in a fully charged state without damage and of bringing batteries from a fully discharge to a fully charged state within 48 hours of normal operation.

O. The emergency voice/alarm panel shall be housed in a UL listed cabinet suitable for flush mounting. The door shall provide a key lock to access system microphone, key alike to the FACP. Operator instructions shall be clearly visible inside of cabinet. All internal components shall be enclosed (ie. dead front panel). All components shall be securely mounted and all cable routed and tie wrapped in a neat, professional manner. All equipment provided shall be UL listed for fire protective signaling.

P. The system shall be a multi-purpose NFPA compliant, supervised, general purpose audio, and fire/emergency evacuation system. Approvals for the system shall include: UL 864, UL 1711, FCC Part 15, CE, CSFM, and MEA. The system shall be OSHA 1910.165 and ADA compliant.

Q. The system shall include a voice evacuation system incorporating supervision during the broadcasting of background music and general paging.

R. Standard on-board system features shall include digital voice messaging, a hand-held push-to-talk microphone with override priority, and a power supply/battery charger. The system shall be capable of interfacing with telephone systems for general paging announcements and will have night ringer capabilities. Form C contacts shall be provide for system alarm and trouble conditions, The system shall have an internal sounder to indicate trouble, and shall be capable of being silenced using a trouble acknowledge switch.

S. The system shall have three fire alarm notification appliance circuit inputs with a voltage range of 9 to 31 VDC. The system shall have eight priority ordered inputs, including: On Board Microphone, Auxiliary Input (Line Level), three Digital Messages, Telephone Paging Input, Night Ringer Input and Background Music Input. The system shall have preset audio levels for emergency messaging (prerecorded and live microphone). The system shall revert to a preset level regardless of the volume set for background music (BGM) or general paging. Background music inputs can be an AM/FM tuner, cassette, CD, or any other remote source. The system shall be supplied with customer unique messages. The system shall have a dual-tone tone generator with Code-3 Tone and Slow Whoop. When the system is on battery power, telephone page, night ring and background music shall be disengaged.

T. The system shall have power-limited circuitry and class B wiring. Wiring terminal blocks will be removable and accept #18 - #12 AWG wire. Audio output voltage shall be selectable for 1V nominal line level, 25V, 70.7V, or 100V. The voice (live microphone or recorded message) frequency response shall be 275 Hz – 6.5 kHz +/- 2.4 dB, background music frequency response shall be 100 Hz – 15 kHz +/- 2.4 dB. The signal to noise ratio shall be better than 65 dB, dynamic range shall be better than 65 dB, total harmonic distortion shall be less than 1%.

U. A microphone shall be located within the main FACP.

V. For all microphones mounted remotely from the voice evacuation control unit, the circuit shall be supervised and activate a trouble signal if the circuit is disturbed.

2.02 REMOTE TRANSPONDER PANELS

A. Distributed Power Module panels (RPS) shall be provided where required. The cabinets shall be surface mounted with a locking door or cover.

B. The contractor shall supply a power modules compatible with the fire alarm control panel. The power module must have 5 amps of output power. The Distributed Power Supply shall be capable of being connected via an RS-485 system bus (SBUS). The power module's RS-485 bus shall be electrically isolated providing ground loop isolation and transient protection.

C. The RPS panels shall accommodate all specified initiating device and command points. Each initiating circuit shall allow a 20 percent expansion of connected detection devices and 20 percent expansion of connected monitor/control points.

D. Normal system power shall be 120 volt AC power provided by dedicated circuits from the local emergency power panel. All circuits shall be protected by circuit breakers of proper size.

E. The RPS panels shall be provided with an emergency standby power system consisting of backup batteries. Batteries shall be sealed lead-acid or gel cell of sufficient capacity to provide 24 hours of standby operation plus 15 minutes in full alarm condition. All calculations shall allow a minimum of 20% safety factor for battery degradation. The loss of AC or DC power at any RPS shall cause a distinct power failure signal.

F. The RPS cabinets shall accept input/output (initiating, supervision, notification and/or command) modules for the specified points, zones and spares.

2.03 REMOTE POWER SUPPLIES/EXPANDERS

A. Provide as required additional power supplies for notification appliance circuits or as a remote power supply. The signal power expander supply/charger and batteries shall supply power limited 24 VDC operating and emergency power. The charger shall be capable of maintaining batteries in a fully charged state without damage and of bringing batteries from a fully discharged to a fully charged state within 48 hours of normal operation. Provide sufficient battery capacity for operation without AC power for twenty-four hours of normal supervision and five minutes alarm operation at the end of this period; include a 20% safety factor in battery calculations to ensure adequate performance for the service life of batteries.

B. A minimum of four notification appliance circuit monitoring and control modules. The modules shall be designed to meet the required circuit Style Y configurations.

C. Strobe synchronization modules

D. Power supply with battery charger and standby batteries. Batteries shall be sized to meet the standby requirements of the FACP.

E. Supervision and activation by the main fire alarm system.

F. Each initiating circuit shall allow a 20 percent expansion

2.04 VOICE EVACUATION SPEAKER SIGNAL POWER EXPANDERS

A. Provide as required additional power supplies for voice evacuation speaker notification appliance circuits, for strobe notification appliance circuits, or as a remote power supply.

B. All interior strobe flashing shall be synchronized with external or built-in synchronization modules at one flash per second to meet UL 1971 requirements.

C. Each evacuation signal power expander supply/charger and batteries shall supply power limited 24 VDC operating and emergency power. The charger shall be capable of maintaining batteries in a fully charged state without damage and of bringing batteries from a fully discharged to a fully charged state within 48 hours of normal operation. Provide sufficient battery capacity for operation without AC power for twenty-four hours of normal supervision and five minutes alarm operation at the end of this period; include a 20% safety factor in battery calculations to ensure adequate performance for the service life of batteries.

D. Each signal power expander shall have an engraved plastic nameplate permanently attached indicating the devices device identification number as documented. Labels shall be 1/16" thick two-ply black/white acrylic sheet engraving stock with all sides beveled.

E. Each signal power expander shall be connected to the FACP such that the trouble contacts on the power expander generate a trouble signal at the FACP.

F. Conduit shall enter the equipment backbox only where conduit entry is specified by the manufacturer.

G. Provide as required series auxiliary power supplies, each with one or two Farenhyt model VIP-50, 50 watt and/or VIP-125, 125 watt audio amplifiers as required, or equivalent.

2.05 MAIN FIRE ALARM SYSTEM EQUIPMENT

A. Alarm Initiating Devices: All alarm initiating devices must be compatible with and UL listed with the fire alarm control panel

1. Point addressable heat detectors listed under UL Standard 521 shall be provided where indicated and where elevator machine rooms and elevator hoistways are sprinkled.

2. Analog addressable photoelectric smoke detectors shall be provided where indicated.

a. Analog addressable photoelectric smoke detectors shall be provided with integral LEDs to indicate detectors in alarm. The detectors shall operate from the two-wire signaling line circuit and be listed under UL Standard 268. Line transient and RFI protection shall be built into the detector.

b. Duct-mounted analog addressable smoke detectors shall be provided where indicated. Motor control wiring shall not be routed through the duct detector housing.

3. The beam smoke detector shall have a operating range of 30 feet by 320 feet and shall have a range of field selective sensitivity setting from 7% to 50% of higher total obscureness. The beam smoke detector shall provide continuous supervision and shall be provided with an automatic gain control that compensates for slow ambient visibility changes. The detector shall operate on 24 VDC from the nearest power source UL listed

for that purpose. The detector shall be supervised for alarm and trouble conditions. The detector shall be installed in accordance with the manufacturer's instructions.

4. Addressable point monitoring interface modules shall be used to monitor the waterflow switches and fire suppression systems. The interface modules shall provide Style B electrical supervision of circuits to monitored devices.

B. Supervisory Devices:

1. Valve supervisory devices existing or shall be furnished and installed by the Sprinkler Contractor and wired by this Contractor as indicated. The valve supervisory devices shall be installed to transmit a supervisory signal within the first two turns of the control valve handle.

2. Accessory relays shall be provided as needed to supervise equipment. All accessory relays shall be SPDT.

3. Addressable point monitor interface modules shall be used to monitor all supervisory points. The interface modules shall provide Styles B electrical supervision of circuits to monitored devices limited to five supervisory switches per initiating device circuit in one room.

C. Control Devices:

1. Provide control relays/contacts where required. The control relays/coils shall be 24 volt DC low voltage type each with number of contacts as required and housed in metal enclosure. The contacts shall be rated for 10 amps as required for continuous duty and for the control circuit voltage.

2. Addressable point control devices shall be used to provide all required control functions.

3. Coordinate all door hold open devices and fire doors with architectural hardware schedule. Provide all things required for code compliant system control.

D. ADA Emergency Call System:

1. Where required, provide and install an ADA Emergency Call System complete and in perfect operating order including boxes, conduit, wiring, telephones, master station and area station (at each rescue assistance area).

2. System:

a. Vandal resistant, 16 gauge, 304 stainless steel.

b. Comply with ADA.

c. Master station NEMA 1 or NEMA 4 (where required) enclosure with lockable door and plexiglass front.

d. Area Stations: Large domed stainless steel engraved 3" diameter button (Push for help) stations to be NEMA 1 or weather resistant where installed outside.

3. All cables shall be as recommended by manufacturer. All area stations must be home run with individually jacketed cable. All cables for exterior installations must be suitable for wet locations and appropriately grounded.

4. Install system per manufacturer's requirements.

5. Confirm final locations of rescue assistance areas with Architect prior to rough-in.

F. SURGE PROTECTION FOR FIRE ALARM CONTROL UNITS

1. In addition to the built-in panel surge protection, each incoming 120 VAC power circuit shall be provided with an electrical surge protection module. Provide one for each fire alarm control unit, which includes every fire alarm control panel, digital communicator, signal power expander and any other 120 VAC powered fire alarm control units. Each power circuit surge protector module shall be mounted in a standard metallic electric box that is grounded and installed adjacent to the FACP, not inside the FACP.. Module shall be hardwired in the incoming power circuit and 20 amp rated with 50kA surge current rating. Unit shall include Form C dry contacts for remote notification of surge protection status and LED diagnostic indicating light. Unit shall provide EMI/RFI filtering. Ditek DTK-120SRD or approved equivalent.

G. FIRE ALARM CIRCUIT SURGE PROTECTION

1. Electrical surge protection shall be provided for all entrance connections and on each copper pair that connects one building to another (i.e. any other portion of a building complex not under one continuous roof) at both exit points to prevent damage to equipment.

2. Fire alarm system circuit surge protectors for SLC, PIV, and NAC circuits shall be mounted in a standard grounded metallic electric box or equipment backboard with a separate ground wire ran directly to the ground bus bar or equipment panel ground stud, do not daisy chain ground wires. Unit shall be mounted in the vicinity of the FACP but not inside the FACP. Each unit shall have a minimum 20kA rating and designed for an operating current of at least 5 amps for NAC and PIV circuits and 1 amp for SLC circuits. Each unit shall include a staged hybrid design utilizing at least two different types of surge protection technology. Shall be Ditek 2MHLP or approved equivalent.

H. FIRE ALARM COMMUNICATION CIRCUIT SURGE PROTECTION

1. Provide surge protection on all telephone communication circuits, Ethernet circuits, or external wireless antenna cables that wire directly to the FACP. Surge devices shall be UL listed for the application.

PART 3 - EXECUTION

3.01 INSTALLATION

A. System components shall be installed in accordance with the latest revisions of the appropriate NFPA code, National Electrical Code, the requirements contained herein, local and state regulations, the requirements of the fire department and other applicable authorities having jurisdiction (AHJ). The Fire Alarm Contractor shall furnish on-the-job supervision for the proper installation of devices in cooperation with, or as may be required by, other trades. This supervision shall include, but not be limited to, the following:

1. Provide specific on-site instructions to others on mounting and installation of each type of device by physically observing the mounting of one or more of each type of device, as required, to assure that the installer is properly instructed in the work.

2. Provide other supervision as required by the trades to properly interface fire alarm installation work.

3. Perform a complete test of all devices, certifying that all devices have been activated and that the devices and systems perform in accordance with the requirements of these specifications.

4. Install, test, troubleshoot and correct all system software provided under these specifications. This includes, but is not limited to, actual keyboard entry, reprogramming required to meet these specifications and any other task associated with the system software.

5. Provide all necessary submittals to the authority having jurisdiction.

B. The Fire Alarm Contractor shall furnish material and labor to provide a properly functioning system as described herein and in project drawings. The system shall operate in accordance with all the requirements of these specifications. No devices or equipment shall be used for any purposes other than their intended ones. This shall include, but not be limited to, the following:

1. Conduit, raceway and wiring systems shall be as indicated herein.

   a. All exposed wiring shall be installed in conduit or wire mold.

   b. All conduit fittings shall be threaded with plastic inserts

   c. All riser wiring and wiring between floors shall be installed in conduit.

   d. Conduit to waterflow and valve supervisory switches shall be weatherproof

   e. Wiring, cables, conduits and raceways shall be neatly run parallel and perpendicular to building lines.

   f. All raceways shall be of metal construction. Plastic conduits shall not be acceptable.

   g. All cable not run in raceway shall be parallel/perpendicular to building lines and secured to the building structure. Provide bridal rings, D rings, or J hooks. Wire shall be neatly bundled with nylon wire ties at a minimum of four feet spacing.

   h. All conduit shall be independently supported from structure. Conduit may not be supported from equipment, piping, ductwork or other trade's supports.

   i. Do not route conduit under ductwork or other equipment.

2. Wire: All wire used on the fire signaling system shall be UL Listed as fire alarm protection signaling circuit cable per National Electrical Code, Articles 760.

   a. Wire used for 120 VDC power circuits shall be minimum 12 AWG solid copper conductors, with THHN insulation and UL listed for fire alarm use.

   b. Fire alarm "SLC" cable (Smoke Detectors, Pull Stations, Etc.) shall be a minimum of 18 AWG, with red/black non-shielded conductor insulation with Plenum rated jacket. (18/2- FPLP)

   c. Fire alarm power cable (Audio/Visual, Door Holders) shall be a minimum of 14 AWG, with red/black non-shielded conductor insulation with Plenum rated jacket. (14/2 FPLP)

   d. Fire alarm "SBUS" cable shall be a minimum of 18 AWG, shielded conductor insulation and Plenum rated jacket. (18/4 FPLP)

e. Voice circuit cable shall be a minimum of 18 AWG shielded conductor insulation and Plenum rated jacket. (18/2)

f. All wiring shall be appropriately sized based upon voltage drop calculations.

g. Any underground wire must be UL Listed for that purpose.

h. Do not run wiring under ductwork or other above ceiling equipment**.**

i. **All fire alarm wire shall match Owner special systems color code requirements, or red and/or red and white stripe only. .**

3. Junction Boxes:

a. System components shall be securely fastened to the building structure. Devices shall not be supported by wiring or by other installed electrical fixtures or conduits.

b. Each box shall be large enough to accommodate required splices and conduit in accordance with NFPA 70.

c. System components shall be securely fastened to the building structure. Devices shall not be supported by wiring or by other installed electrical fixtures or conduits.

d. Boxes at sprinkler risers shall be weatherproof.

e. Provide box covers for all new and reused junction boxes.

4. Patching of all walls, floors, and ceilings which are penetrated or damaged during construction and returning the surface to a condition matching existing adjacent surfaces.

a. All slab penetrations shall be completely sealed and made watertight.

b. Restore all fire rated walls to rated conditions. All fire rated wall penetrations shall be made in conduit and sealed with UL Listed “fire stop” caulking.

5. Mounting:

a. All devices shall be mounted in accordance with the manufacturer’s instructions and shall utilize the manufacturer’s suggested mounting box.

b. Surface-mounted devices shall be smooth sided, without knockouts.

c. Point addressable monitor modules and control modules shall be securely mounted in back boxes in an accessible location.

d. Field devices shall be labeled and all labeling recorded on “as-built drawings” indicate location, address and type of remote devices.

e. Devices shall be flush or semi-flush mounted where possible.

f. System components shall be placed and installed to comply with the Americans with Disabilities Act.

g. All surface mounted devices shall be installed with appropriate back boxes. All work shall be neat and performed in a craftsman like manner.

h. All devices, which are mounted behind walls, shall be provided with access panels. Location of access panels shall be coordinated with the Owner.

i. Fire alarm system devices shall not be installed where they may interfere with the operation of other building systems, devices or features.

j. Devices and wiring installed in suspended ceilings shall be supported with appropriate bridge supports and ties.

6. No cabling or conduit shall be run under ductwork, mechanical equipment or in front of access doors.

C. Pay for all permits, fees and charges required for this work.

3.02 TESTS FIELD QUALITY CONTROL

A. The commissioning alarm test shall be coordinated with the Owner, Engineer and AHJ. A letter certifying that the installation is complete per drawings and specifications and fully operational per NFPA 72 shall be forwarded to the Owner and Engineer.

B. The Owner, Fire Alarm Contractor, Fire Alarm System Supplier, the Engineer and an authorized representative from each supplier of equipment shall be in attendance at the commissioning test to make necessary adjustments. A commissioning test shall be conducted in accordance with NFPA 72 and Authority Having Jurisdiction requirements. The test shall include, but not be limited to:

1. A test of the system for grounded, opened and shorted circuits.

2. A test of each alarm and new supervisory signal-initiating device for functions specified.

3. A test to verify that the alarm signals will operate under specified trouble conditions.

4. A test to verify that the components and wiring will operate under specified trouble conditions.

5. A test to verify that the system will perform all specified tasks.

3.03 TRAINING

A. Provide training for the operating personnel in proper system operation and required user maintenance procedures.

B. The training program for the personnel shall include the following:

1. Three customized Operating & Maintenance Manuals – Printed, comprehensive installation and maintenance manuals, assembled with covers and conforming to the specified equipment supplied, shall be furnished with the equipment. The manual shall include a material guide which shall include the replacement part numbers and description of all components used. The manual shall provide sufficient, concise information, including schematics, troubleshooting diagrams, layout drawings, printed circuit overlays, test and alignment procedures, interconnect diagram parts list, compatibility charts and theory of operation of all active devices to permit quick, efficient maintenance and repair of the equipment by a competent Fire Alarm Systems Technician.

2. Two separate 1-hour training sessions for operating personnel. These sessions are to cover proper operating and response procedures. These instructions shall be sufficient to enable a previously untrained person to properly operate the system.

3.04 RECORD DOCUMENTS

A. Contractor to obtain architectural backgrounds for producing shop drawings from the Architect. Electrical Engineer cannot provide architectural backgrounds.

B. Provide two (2) full size prints, and a set of disks in AutoCAD 2004 format of drawings and wiring diagrams reflecting “as-built” conditions to the Owner.

C. Provide one (1) complete sets of “as-built” data sheets for all system -connected equipment to the Owner.

D. Provide two (2) sets (hard copies) of the complete “as-built” software listing of all data files, event programs, print statements, etc. to the Owner.

E. Provide a completed test form, which complies with NFPA 72, signed and dated by the fire alarm contractor.

F. Provide completion certificate, signed by the authority having jurisdiction.

G. Provide manufacturer’s recommended cleaning procedure for smokes detectors.

H. Provide manufacturer’s recommended calibration procedure for smokes detectors.

I. Provide additional copy of Record Drawings in Document Box

END OF SECTION

CIVIL SECTIONS

DIVISION 01 – GENERAL REQUIREMENTS:

01 57 15 – DUST CONTROL

DIVISION 02 – EXISTING CONDITIONS:

02 41 13 – SELECTIVE SITE DEMOLITION

DIVISION 31 – EARTHWORK:

31 11 00 – CLEARING AND GRUBBING

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31 14 31.23 - TOPSOIL STRIPPING AND STOCKPILING

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32 11 23 - AGGREGATE BASE COURSE

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32 17 13 - PARKING BUMPERS

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32 91 19.13 – SPREADING AND GRADING TOPSOIL

32 92 02 - SODDING

32 92 19.16 - HYDRAULIC SEEDING

Texas Registered Firm Number F1186

DIVISION 01 – GENERAL REQUIREMENTS

01 57 15 DUST CONTROL

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.

B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.02 SUMMARY

A. A. Perform all Work required to prevent and control dust in accordance with all applicable Federal, State, and local laws and regulations concerning the prevention and control of dust pollution.

B. B. Contractor furnish all the labor, equipment, materials, and means required, and carry out proper and efficient measures wherever and as often as necessary to reduce the dust nuisance to persons, and to prevent damage by dust originating from operations to vehicles, buildings, existing vegetation or any other properties. Contractor shall be liable for any damage resulting from dust originating from operations during this Project.

C. C. Contractor shall prepare a Dust Control Plan, as described within this Section, for Owner review and approval.

1.03 REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

C. The Contractor shall be responsible at all times for compliance with applicable laws and regulations pertaining to dust control and opacity monitoring at the Site, including but not limited to those contained in Title 30 of the Texas Administrative Code (TAC), Chapter 111 (30 TAC §111.111, 30 TAC §111.143, 30 TAC §111.145, 30 TAC §111.147, and 30 TAC §111.149), as hereafter amended.

1.04 QUALITY ASSURANCE

A. In addition to providing the Dust Control Plan, the Contractor shall provide for Owner review a copy of the daily check list on which Contractor Representatives will document the performance of the activities contained in the Dust Control Plan.

PART 2 - PRODUCTS

2.01 DUST CONTROL PLAN

A. Prior to beginning construction, the Contractor shall provide a written Dust Control Plan to the Owner for review.

B. Dust Control Plan shall include, but not be limited to, a description of the control processes that the Contractor will implement in order to address the following:

1. How grading operations will be handled/suspended when winds exceed 30 miles per hour.

2. How water will be applied to all surfaces prior to, and if necessary during, excavation.

3. How water or a covering will be applied to all particulate materials contained in open-bodied trucks, trailers or other vehicles transporting particulate matter prior to operation of the vehicle, in order to prevent dust from

becoming airborne during transportation.

4. How water or a covering will be applied to all stockpiles of particulate material to prevent dust from becoming airborne during high windy conditions.

5. How transfer processes involving free fall of soil or other particulate matter will be performed in order to minimize free fall distance and thus reduce dust emissions.

6. How and when water will be applied to unpaved surfaces, including commercial roads, or any other surface that can create airborne dust in order adequately to control dust emissions.

7. How and when ground cover on the construction site will be reestablished prior to final occupancy.

8. The designated routes within the job site that will be used by vehicles transporting soil or other materials to and from the site.

9. How soil, sand, dirt and any other particulate matter will be removed from vehicle tires and undercarriages prior to leaving the site, in order to prevent trackout on the adjacent public roads.

10. The maximum speed limit on unpaved roads through the site, and how and where speed limit signs will be posted along the haul road routes so that they are visible to vehicles entering and leaving the site.

11. How and when soil, sand and other particulate material deposited or emitted onto any public thoroughfare near construction will be removed.

12. How dust control systems and/or devices, including; but not limited to water application systems, filter replacement, or daily removal of excess dust from containment areas, will be maintained.

PART 3- EXECUTION

3.01 DOCUMENT AVAILABILITY

A. The Contractor shall make the Dust Control Plan and the Daily Dust Control Checklist available at the job site for periodic review, inspection and copying by Owner's representatives, regulatory agencies including but not limited to EPA and TCEQ, and other persons legally permitted to review them.

END OF SECTION 01 57 15

DIVISION 02 – EXISTING CONDITIONS

02 41 13 SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Permits.

B. Site conditions.

C. Materials, equipment, and facilities.

D. Preservation of reference markers.

E. Demolition.

F. Removal.

G. Salvage.

H. Disposal of removed materials and debris.

1.02 RELATED SECTIONS

A. Section 31 11 01 - Site Preparation,

1.03 QUALIFICATIONS

A. Demolition Firm: Company specializing in performing the work of this Section with minimum of 3 years' experience.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for demolition of structures, safety of adjacent structures, dust control, runoff control, disposal, relocation of fire line, removal of existing equipment, etc.

B. Obtain required permits from authorities.

C. Notify affected utility companies before starting work and comply with their requirements.

D. Do not close or obstruct roadways, sidewalks, and/or hydrants without Owner's permission.

E. Conform to applicable regulatory procedures if hazardous or contaminated materials are discovered,

1.05 SCHEDULING

A. Contractor shall provide a demolition removal procedures list and schedule for approval by Owner prior to beginning any demolition work.

B. Contractor shall perform all work required to provide access to bus lane and complete all such work on or before dates given by Owner when school activities are scheduled.

PART 2 - PRODUCTS

2.01 FILL MATERIALS

A. Fill Material: Shall consist of select fill free of organics, stones greater than 3 inches and free of debris. Compacted fill shall be placed in accordance with TxDOT Item 247 Type A, Grade 1. This shall be for areas not covered in building or pavements. Fill material under building or pavements shall conform to the requirements in Section 31 00 00 EARTHWORK.

PART 3 - EXECUTION

3.01 PREPARATION

A. provide, erect, and maintain temporary barriers and security devices at locations necessary for the continued safety of the administration staff and faculty.

B. Protect existing landscaping materials, appurtenances, structures and pavement, which are not to be demolished.

C. Prevent movement or settlement of adjacent structures. Provide bracing and shoring if required.

D. Mark location of utilities. The utility locations shown on the drawings are from questionable sources and Record drawings (NOT from "as-builts") and represents the best information available. The Contractor shall be responsible for locating all utilities, and for repairs of any damaged utilities.

3.02 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent structures and occupancies.

B. Cease operations immediately if adjacent structures appear to be in danger. Notify Owner or Architect/Engineer. Do not resume operations until directed.

C. Conduct operations with minimum interference to public or private accesses. Maintain protected egress and access at all times (except when allowed during vacation periods as allowed by Owner).

D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

E. Sprinkle Work with water to minimize dust. Provide hoses and water connections for this purpose. Dust control shall conform to the requirements in Section 01 57 15 DUST CONTROL.

3.03 DEMOLITION

A. Disconnect remove, cap and identify designated utilities within demolition areas.

B. Remove concrete slabs on grade.

C. Remove materials to be re-installed or retained in manner to prevent damage.

D. Backfill areas excavated open pits and holes caused as a result of demolition, with the fill material stipulated in this section. Place all fill in lifts not to exceed 8 inches loose measure, and/or compacted thickness to exceed 6 inches. All fill material shall be compacted to at least 95% of ASTM D-698 max. dry density at a moisture content between -2 and +3 percent of optimum moisture.

E. Rough grade and compact areas affected by demolition to maintain site grades and contours.

F. Remove demolished materials from site.

G. Do not burn or bury materials on site. Leave site in clean condition.

H. Remove temporary work.

3.04 SCHEDULES

A. Items to be removed, stored, and protected for re-installation:

1. None.

B. Items to be removed by Owner.

1. Other equipment as designated by Owner. Owner hereby reserves the right to select salvaged and/or demolished items for re-use elsewhere.

C. Items to be protected:

1. Existing trees and shrubs (except as designated for removal on drawings).

2. Existing utilities to remain.

3. Existing fences and gates to remain.

4. Existing sidewalks.

END OF SECTION 02 41 13

DIVISION 31 – EARTHWORK

SECTION 31 11 00 CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Clearing and grubbing

B. Tree branches

C. Demolition/removal

D. Disposal of removed materials and debris

E. Salvage

F. Backfill

1.02 RELATED SECTIONS

A. Temporary facilities, such as fences, barricades, warning lights, and other temporary safety measures, are specified in Section 01 52 00 - Construction Facilities.

B. Dust control is specified in Section 01 57 00 - Dust Control.

C. Demolition of structures and removal, salvage, or other disposition of slabs, footings and foundations; existing pavement, curbs and gutters, sidewalks, headwalls, walls, and steps; utility service facilities; guardrail and posts, highway and street signs and fences; and other miscellaneous structures and site improvements that interfere with new construction are specified in Section 02 41 00 - Demolition.

D. Removal of items that are buried below grade is specified in Section 31 00 00 - Earthwork.

1.03 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, for submittal requirements and procedures.

B. Utility Severance Certificates: Provide certificates of severance of utility services, issued by the utility owners, for review and record purposes. Submit copies of certificates for record documents in accordance with the requirements of Section 01 78 39 - Project Record Documents.

1.04 REGULATORY REQUIREMENTS

A. Regulatory requirements that govern the work of this Section include the following governing codes:

1. City Ordinances for Trees

2. County , City or State Ordinances for Storm water runoff

1.05 JOBSITE CONDITIONS

A. Dispose of cleared, grubbed, and removed material away from the site. Burying and burning of materials at the site will not be permitted. Stockpile salvaged material in a secured location.

B. Clear and restore areas used for the Contractor's convenience. Restore such areas to their original condition, and provide

mulching, seeding, and planting as required.

C. Protect survey markers and monuments, existing improvements, and adjacent properties from removal and damage.

D. Give written notices to utility companies and municipal departments requesting discontinuance of services to areas that will be affected by the site clearing and grubbing work.

E. Provide noise and dust abatement as specified in Section 01 57 00 - Dust Controls.

1.06 CARE OF EXISTING TREES

A. Trees and plants indicated in the Contract Documents to remain and to be preserved shall be protected from damage by constructing suitable barriers or fences at, or near, the driplines of the trees and plants. Vehicles, equipment, materials, and debris shall not be placed or parked in these areas or under trees to remain.

B. Feed, water, and maintain protected trees and plants in a healthy, growing condition during the construction period.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. The Contractor shall furnish all materials, tools, equipment, facilities, and services as required for performing site clearing, grubbing and other site preparation work.

PART 3 – EXECUTION

3.01 CLEARING AND GRUBBING

A. Perform clearing and grubbing as necessary to remove vegetation and objectionable material from the site. Clear the site within the limits indicated, and remove cleared materials and debris from the site. Unless otherwise indicated, clearing and grubbing shall include removing the top 6 inches of the existing ground. Coordinate with salvaging of topsoil specified in Section 31 00 00 - Earthwork.

B. Remove stumps and roots completely in excavation areas and under embankments where the original ground level is within 3.5 feet of sub grade or slope of embankments. In embankment areas, where the original ground level is more than 3.5 feet below the sub grade or slope of embankment, cut off trees, stumps, and brush at ground level
.

C. Do not start earthwork operations in areas where clearing and grubbing are not complete, except that stumps and large roots may be removed concurrently with excavation.

D. Where the work includes requirements for wood chip mulch, acceptable material from clearing and grubbing activities may be used to produce such mulch.

3.02 TREE BRANCHES

A. A. Remove tree branches overhanging buildings, roadways, and other designated areas of the site to within 13 feet of finish grade. Cut off branches neatly and close to the tree boles. Remove other branches as necessary to present a balanced appearance. Treat scars resulting from tree branch removal with a heavy coat of an approved asphaltic tree paint.

3.03 DEMOLITION/REMOVAL

A. Coordinate the work of this Section with the work of Section 02 41 00 - Demolition, as required to remove existing pavements, curbs, structures and site improvements that interfere with new construction and where demolition is not indicated.

B. Remove walls and masonry construction to a minimum depth of 2 feet below existing ground level in areas where such items do not interfere with new construction.

C. Take possession of, remove, and dispose of abandoned rail and track materials.

D. Slabs may be broken for drainage and left in place where they are below grade and the Engineer determines it is not detrimental to the structural integrity of the fill or structure to be placed above.

3.04 DISPOSAL OF REMOVED MATERIALS AND DEBRIS

A. Dispose of removed materials, waste, trash, and debris in a safe, acceptable manner, in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction.

B. Burying of trash and debris on the site will not be permitted. Burning of trash and debris at the site will not be permitted.

C. Remove trash and debris from the site at frequent intervals so that its presence will not delay the progress of the Work or cause hazardous conditions for workers and the public.

D. Removed materials, waste, trash, and debris shall become the property of the Contractor and shall be removed from the District's property and disposed of in a legal manner. Location of disposal site and length of haul shall be the Contractor's responsibility.

3.05 SALVAGE

A. Refer to Section 02 41 13- SELECTIVE SITE DEMOLITION, for salvage requirements.

3.06 BACKFILL

A. Backfill trenches and excavations resulting from work under this Section in accordance with applicable requirements of Section 31 00 00 - Earthwork.

END OF SECTION 31 11 00

SECTION 31 11 01 SITE PREPARATION

1.01 SECTION INCLUDES

A. Remove surface debris.

B. Clear site of plant life and grass.

C. Remove designated trees and shrubs.

D. Remove root system of trees and shrubs.

E. Topsoil excavation.

F. Protect all trees to remain (none designated as such).

G. Demolition of miscellaneous existing site concrete.

1.02 RELATED SECTIONS

A. Section 31 22 13 - Rough Grading.

B. Section 31 20 00 - Earthwork.

C. 01 57 23 Temporary Storm Water Pollution Control

1.03 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris, burning debris on site, and use of herbicides.

B. The project site is located within the City of New Braunfels, Texas. The City of New Braunfels and Comal County and the Texas Commission on Environmental Quality regulates all development within the site. The Contractor shall not modify any site requirements without obtaining approval from the City of New Braunfels, Comal County, and/or the TCEQ before proceeding with the changes. Any proposed modifications shall not be initiated until the City of New Braunfels, Comal County, and/or the TCEQ provides site plan approval.

PART 2 - PRODUCTS

2.01 MATERIALS

A. See Section 31 25 00 Erosion and Sedimentation Controls for types of pollution control measures required.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that existing plant life designated to remain, is protected with a fence completely around to the "dripline" of the vegetation or with 2" thick wood tightly wrapped around the trunk of the trees. Contact the Owner to determine requirements.

B. Install silt fence, rock berms, construction entrance, and triangular dike fences completely at the site as shown on the site plans in accordance with the notes shown on the each of the details. Where the silt fence toe trench cannot be dug in because of rock or existing asphalt, Contractor shall anchor toe away from downstream feature by use of washed pea gravel. Alternative methods of silt protection may be proposed by the Contractor, but must be accepted by the corresponding authority.

3.02 PROTECTION

A. Protect trees, plant growth, and features designated to remain, as final landscaping.

B. Protect bench marks from damage or displacement. Contractor shall bear costs to reestablish bench marks.

3.03 CLEARING

A. Clear all areas required for access to site and execution of Work. Remove all roots and vegetation.

B. Clear undergrowth and deadwood, from entire site without disturbing subsoil.

3.04 REMOVAL

A. Remove debris, rock, and extracted plant life from site and dispose of properly. Dispose of extracted plant life off-site in an acceptable disposal site.

3.05 TOPSOIL EXCAVATION

A. Excavate topsoil from entire work area and stockpile where designated by plans and/or by Owner's Representative.

B. Stockpile topsoil to a depth not exceeding 8 feet on site. Protect all stockpiles from erosion by preventing runoff from traversing stockpile areas. Place silt fence on the downhill side of the stockpile site.

C. Do not excavate wet topsoil.

END OF SECTION 31 11 01

SECTION 31 14 31.23 TOPSOIL STRIPPING AND STOCKPILING

PART 1 – GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

Drawings and general provisions of contract including General and Supplementary Conditions and Division-1 specifications section apply to work specified in this section. With respect to the site work documents, including plans, specifications and other supplemental information, it is understood that as applicable, the word "Architect", as used in the General Conditions, will be replaced with the word "Engineer."

1.02 RELATED SECTIONS

A. Erosion and Sediment Controls - Section 31 25 00.

B. Rough Grading - Section 31 22 13.

C. Spreading and Grading Topsoil - Section 32 91 19.13.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Topsoil is defined in Section 31 22 19.13.

PART 3 - EXECUTION

3.01 STRIPPING, STOCKPILING AND STABILIZING TOPSOIL

A. Strip topsoil from areas where the finished work of the Project will result in changes in existing grades. Strip topsoil to a depth which will expose subgrade. Do not mix subgrade soil with topsoil.

B. Provide initial cleaning by removing roots, root mat, brush, trash, and stones larger than 2 inches in any dimension.

C. Stockpile topsoil in one or more approved locations on the site. Once stockpiled, topsoil shall be preserved for use only as topsoil to be spread on subgrades at specified elevations. Topsoil must not be used as general fill to achieve required subgrade elevations except to the extent that there is excess topsoil over and above that which is needed to satisfy the project's requirements, and use as general fill is approved by Geotechnical Engineer.

D. If not used within two weeks after stockpiling, stabilize stockpiled topsoil by temporary seeding, netting, or other covering, and maintain in non-eroding and non-dusting condition in accordance with the Soil Conservation certification.

E. Surplus topsoil, if any, at completion of the Project Work, shall be dispersed on the site at location(s) later designated.

END OF SECTION 31 14 31.23

SECTION 31 22 13 ROUGH GRADING

PART 1 - GENERAL

Drawings and general provisions of Contract, as well as all the appropriate specification sections of Division 1, apply to work of this section.

1.01 SECTION INCLUDES

A. Removal of subsoil (removal of topsoil covered in Site Preparation).

1.02 RELATED SECTIONS

A. Section 31 11 01 - Site Preparation.

B. Section 31 41 33 - Trench Shielding,

C. Section 31 22 19 - Finish Grading: Finish grading with topsoil to contours.

1.03 REFERENCES

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

C. ANSI/ASTM D1556 - Test Method for Density of Soil in Place by the Sand-Cone Method.

D. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

E. ASTM D2167 - Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.

F. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

G. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.04 JOB CONDITIONS

A. Dust Control:

1. Use all means necessary to control dust on the Work area or if resulting from the condition in which the Contractor leaves the site.

2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the neighbors.

1.05 PROTECTION

A. Protect all reference points, bench marks and monuments from damage or dislocation. Replace or repair immediately all points damaged, destroyed or dislocated.

B. Sprinkle and dampen all dusty material from the beginning of work to its completion.

C. Provide, erect and maintain all lights, barricades, warning signs, temporary chain link fences, and guards as necessary for the protection of roads, parking lots, sidewalks and all adjoining structures.

D. To prevent caving of earth banks and side walls of trenches, shoring and sheet piling, trench box, or other OSHA approved methods may be used for safety. Trench walls may be laid back at 2:1 slopes for temporary use, 3:1 slopes for uses requiring the trench to remain open for longer than 2 days.

E. Trenches deeper than 5' shall meet the requirements of Section 31 41 33 TRENCH SHIELDING.

F. Cover holes and trenches when work is not in progress. Fence or barricade any changes of grade.

G. Remove shoring, sheet piling and protection as work progresses. Temporary wood shall not be left in concrete or fill.

H. Keep trenches and excavated areas free from water by pumping or draining. Grade to drain surface water away from excavations, distributing discharge to prevent excessive erosion.

I. Protect adjacent surface areas outside the construction limits from damage. If damaged as a result of construction operations or storage of materials, clear off debris and restore to original grades and condition, or better, subject to approval by the Owner's Representative.

J. Protect finished subgrade from erosion, as directed by the Owner's Representative, by the use of organic erosion netting or fabric and/or the use of silt fence barricades. All areas of erosion to be repaired, compacted, subject to approval by Owner's Representative.

1.06 CLASSIFICATION OF EXCAVATION

A. No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.07 DEFINITIONS

A. Satisfactory Materials: Materials classified in Unified Soil Classification System as GW, GP, GC, GM, SW, SP, SM, SC, CL and CH, as determined by the Owner's testing laboratory.

B. Unsatisfactory Materials: Materials classified in Unified Soil Classification System as PT, OH, OL, ML and MH, as determined by the Owner's testing laboratory.

C. Cohesionless and Cohesive Materials: cohesive materials include materials classified as GC, SC, ML, CL, MH and CH. Cohesionless materials include materials classified in Unified Soil Classification System as GW, GP, SW and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero. Testing required for classifying materials shall be in accordance with ASTM C136, D422 and D1140.

D. Degree of Compaction: Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D698.

E. Topsoil: Topsoil shall be defined as natural, friable surface soil possessing the characteristics of representative soils in the vicinity that produce heavy growth of crops, grass or other vegetation. See SECTION 31 20 02 – FINISH GRADING.

1.08 BLASTING

A. Blasting will not be permitted without provision by the Contractor of blast monitoring and a pre-blast survey by a reputable soils engineering firm. The Contractor shall, if considering blasting, monitor velocity and amplitude of surface waves to insure that particle velocities are below those that cause structural damage.

B. All blasting shall be performed only by professionals licensed as such by the local City or County Jurisdiction. Controlled blasting is allowed for the convenience of the Contractor. The Contractor is hereby placed on notice that if blasting is performed it is at the Contractor's discretion and the Contractor shall be fully responsible for ALL litigation and complaints arising from the blasting operation.

1.09 UTILIZATION OF EXCAVATED MATERIALS

A. All unsatisfactory materials removed from excavations shall be disposed of OFF the site or on-site as directed and approved by the Owner's Representative. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed by the Owner's Representative. Newly designated waste areas on the site shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels, and for protecting against erosion. No excavated material shall be disposed of in such a manner as to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

1.10 FIELD TESTING CONTROL

Field density testing shall be performed by an Independent Testing Laboratory selected by the Owner's Representative. Costs of initial testing will be paid by the Owner. Should the material fail to meet the specified density, material shall be scarified, recompacted and tested until specified densities are obtained. All subsequent retesting of material shall be paid for by the Contractor.

1.11 CUT AND FILL BALANCING

The cut and fill on this Project is NOT balanced. Contractor shall determine whether there is excess cut or excess fill prior to completing his/her bid.

EXCESS CUT - The Contractor shall have included in his/her bid the cost of properly disposing of ALL excess material OFF SITE in an approved sanctioned disposal site by the County for such purpose.

EXCESS FILL – The Contractor shall have included in his/her bid the cost of bringing in suitable material from OFF-SITE sources to complete the slopes, embankment or other fill areas.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil: Unclassified top 4 to 12 inches from within limits of construction.

B. Compacted Fill: Clayey sand or sandy clay material consisting of suitable earth material meeting the following requirements:

1. Free of organics and debris
2. Between 30 and 70 percent of total sample retained on No. 200 sieve
3. Plasticity Index of 5 to 20 on minus No. 40 material
4. 60 percent or more of the total sample passes the No. 4 sieve
5. Gravel/stones no larger than 3 inches in their greatest dimensions

PART 3 - EXECUTION

3.01 GENERAL

A. Construction surveying, staking and layout shall be performed at the Contractor's expense supervised by a surveyor licensed in the State of Texas.

B. The rough grading shall be performed to the lines and elevations indicated on the drawings in accordance with these specifications. Should the Contractor, through negligence or other fault, excavate below the designated lines, he shall

replace the excavation with approved materials, in an approved manner and condition, at his own expense. The Owner's Representative shall have complete control over the excavation, moving, placing and disposition of all materials and shall determine the suitability of material to be placed in embankments. All material determined unsuitable shall be disposed of off-site. Topsoil shall not be used in fills or in subgrades but shall be handled and placed as directed.

C. The Contractor shall inform and satisfy himself as to the character, quantity and distribution of all material to be excavated.

3.02 PREPARATION

A. Except as otherwise permitted, cut areas and other excavation areas shall be excavated in such manner as will afford adequate drainage. Overburden and other fill material shall be transported to designated spoil areas or otherwise disposed of as directed by the Owner's Representative. The Contractor shall insure that excavation of any area, or dumping of soil material results in minimum detrimental effects on natural environmental conditions and/or all manmade features to remain.

3.03 EXCAVATION

A. Perform excavation of every type of material encountered within the limits of the project to the lines, grades and elevations indicated and as specified herein. Grading shall be in conformity with the drawings and the tolerances specified in paragraph 3.8. - Finishing. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered shall be replaced with satisfactory materials as directed. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in off-site Contractor provided areas approved for surplus material storage or designated spoil areas. Unsatisfactory excavated material shall be disposed of in off-site in Contractor provided designated spoil areas approved by the Owner's Representative. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be obtained from Contractor provided borrow areas.

B. Ditches, Gutters and Channel Changes: Excavation of ditches, gutters and channel changes shall be accomplished by cutting accurately to the cross sections, grades and elevations shown. Care shall be taken not to excavate ditches and gutters below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory thoroughly compacted material or with suitable stone or cobble to grades shown at no additional cost to the Owner. Material excavated shall be disposed of as shown or directed, except that in no case shall material be deposited less than 4 feet from the edge of a ditch. The Contractor shall maintain all excavations free from detrimental quantities of leaves, brush, sticks, trash and other debris until final acceptance of the work.

C. Excavate subsoil from areas to be further excavated, re-landscaped, or re-graded, over the entire site.

D. Do not excavate wet subsoil.

E. When excavating through roots of trees that are to remain, perform work by hand and cut roots with sharp axe.

3.04 BACKFILL

A. Backfill adjacent to any and all types of structures shall be placed in 8" thick un-compacted lifts and compacted to at least 95 percent of maximum density in accordance with ASTM D698 in such a manner as to prevent wedging action or eccentric loading upon or against any structure. Compaction shall be accomplished by sheep's foot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the materials being compacted.

3.05 PREPARATION OF GROUND SURFACE FOR FILLS OR EMBANKMENTS

A. Clearing and Grubbing: Ground surface on which fill is to be placed shall be stripped of live, dead or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 95 percent of maximum density in accordance with

ASTM D698.

B. Proof Rolling: Compacted fill area subgrade shall be proof rolled to detect any areas of weakness. Areas of weakness should be undercut to firm soils and re-compacted to at least 90 percent of maximum density in accordance with ASTM D698.

1. The proof rolling equipment shall consist of not less than four pneumatic tired wheels, running on axles carrying not more than two wheels, and mounted in a rigid frame and provided with loading platform or body suitable for ballast loading. All wheels shall be arranged so that they will carry approximately equal loads when operating on uneven surfaces.

2. The proof roller under working conditions shall have a rolling width of from 8 feet to 10 feet, and shall be so designed that, by ballast loading, the gross load may be varied uniformly from 25 tons to 50 tons. The tires shall be capable of operating under the various loads with variable air pressure up to 150 pounds per square inch. Tires shall be practically full of liquid. (Tires shall be considered as being practically full of liquid, when liquid will flow from the valve stem of a fully inflated tire with the stem in the upper-most position).

3. The proof roller shall be drawn by a suitable crawler type tractor or rubber tired tractor of adequate tractive effort, or may be of self-propelled type, and the roller unit when drawn or propelled by either type of equipment shall be considered a heavy pneumatic tire proof roller unit.

4. There shall be a sufficient quantity of ballast available to load the equipment to a maximum gross weight of 50 tons.

5. In lieu of the rolling equipment specified, the Contractor may, upon written permission from the Owner's Representative, operate other compacting equipment that will produce equivalent results in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired results within the same period of time as would be expected of the specified equipment, and determined by the Owner's Representative, its use shall be discontinued.

C. Preparation: The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of fill or embankment materials to assure adequate bond between fill or embankment material and the prepared ground surface.

3.06 FILLS OR EMBANKMENTS

A. Earth Fills or Embankments: Earth fills or embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater that 8 inches. The material shall be placed in successive horizontal layers of loose material not more than 8 inches in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 95 percent of maximum density in accordance with ASTM D698 (at optimum moisture). Compaction shall be accomplished by sheep's foot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment will suited to the type of material being compacted.

3.07 RAW SUBGRADE PREPARATION

A. Construction: Raw subgrade shall be shaped to line, grade and cross section and proof rolled with at least a 15 ton pneumatic roller to detect weak areas. Weak areas shall be removed and replaced with soils of similar classification, moisture content, and adjacent in-situ soils. Raw subgrade preparation operation may include plowing, disking and any moistening or aerating required to attain specified compaction. Soft or other unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 6 inches below finished grade for the raw subgrade and all loose fragments removed. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade and cross section and

compacted as specified.

B. Compaction: Compaction shall be accomplished by sheep's foot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the type of material being compacted. Subgrade shall be compacted to at least 95 percent of maximum density at minus one to plus 3 of the optimum moisture content in accordance with ASTM D698, for a minimum depth of six inches.

3.08 FINISHING

A. The surface of all excavations, fills, embankments and raw subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades and cross sections or elevation shown. The degree of finish for all graded areas shall be within 0.1 foot of the grades and elevation indicated and/or specified in Section 31 22 19 - Finish Grading: Finish grading with topsoil to contours shown on the drawings.

3.09 RAW SUBGRADE AND FILL OR EMBANKMENT PROTECTION

A. During construction, fills, embankments and excavations shall be kept shaped and drained. Ditches and drains along raw subgrade shall be maintained in such a manner as to drain effectively at all times. The finished raw subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition, subject to approval by the Owner's Representative.

3.10 TRENCHING

A. General:

1. Perform all trenching required for the installation of items where the trenching is not specifically described in other sections of these Specifications.

2. Make all trenches open vertical construction with sufficient width to provide free working space at both sides of the trench and around the installed item as required for caulking, joining, backfilling, and compacting.

B. Depth: Trenching as required to provide the elevations shown on the Drawings.

C. Correction of faulty grades: Where trench excavation is inadvertently carried below proper elevations, backfill with material approved by the Owner's Representative, and then compact to provide a firm unyielding subgrade and/or foundation to the approval of the Owner's Representative and at no additional cost to the Owner.

3.11 Excavations, Trenching, and Shoring Safety:

A. The Contractor shall strictly observe the pertinent portions of Section 31 41 33 - Trench Shielding (as they apply to all trenches deeper than 5'. The Occupational Safety and Health Standards and Interpretations "Subpart P-Excavations", Paragraphs 1926.650 through 1926.652 with Appendix A through F inclusive, and shall have the same force and effect as if bound or copied directly into the Technical Specifications. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO FAMILIARIZE HIMSELF/HERSELF WITH ALL OF THE REQUIREMENTS AND TO STRICTLY ADHERE TO ALL OF THEM. The cost for all shoring, sheeting, bracing, sloping, etc. for excavation and trench safety shall be included in the Contractor's bid.

B. Brace, sheet and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind, whether on public or private property, will be fully protected from damage.

C. In the event of damage to such improvements, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the owner.

D. Arrange bracing, sheeting, and shoring so as to not place stress on any portion of the completed Work until the general construction thereof has proceeded far enough to provide sufficient strength.

E. Removal of trench bracing: Exercise care in the drawing removal of sheeting, shoring, bracing, and timbering to prevent collapse and caving of the excavation faces being supported.

END OF SECTION 31 22 13

SECTION 31 22 19 FINISH GRADING

PART 1 - GENERAL

Drawings and general provisions of Contract, as well as all the appropriate specification sections of Division 1, apply to work of this section.

1.01 SECTION INCLUDES

A. Final grade topsoil for finish grading.

B. Final grade smooth all areas inside the limits of construction and where ever abraded by contractor, by disking. Care should be taken to prevent rain from changing the final grades.

1.02 RELATED SECTIONS

A. Section 31 22 13 - Rough Grading: Site contouring.

B. Section 32 92 02 – Sodding: Finish ground cover.

C. Section 32 92 19.16 – Hydraulic Seeding: Finish ground cover.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Topsoil: Acceptable stockpiled material as approved by the Owner's Representative, or

B. Contractor's source - sandy loam consisting of sandy clay of clayey sand without trash, wood, rocks over 1" in size or any other objectionable material. Large clumps shall be broken up by disking.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify all backfilling has been completed.

B. Verify substrate base has been contoured and compacted.

3.02 SUBSTRATE PREPARATION

A. Eliminate uneven areas and low spots.

B. Remove debris, roots, branches, stones.

C. Scarify subgrade to depth of three (3) inches where topsoil is scheduled. Scarify in areas where equipment is used for hauling and spreading topsoil and has compacted subsoil.

3.03 PLACING TOPSOIL

A. Place topsoil in areas where seeding or sodding is to occur, to a minimum depth of four (4) inches. Place topsoil during dry weather.

B. Fine grade all abraded areas and newly placed topsoil by eliminating rough or low areas. Maintain profiles and contour of subgrade. Maintain positive drainage to all area drains.

C. Remove roots, weeds, rocks and foreign material while spreading.

D. Manually spread topsoil close to structures, trees, rock rip-rap to prevent damage to same.

E. Roll placed topsoil.

F. Remove surplus subsoil and topsoil from site.

G. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.04 TOLERANCES

A. Top of Topsoil: Plus or minus 0.1 foot.

B. Top Soil Thickness: Topsoil shall be 4 inches thick in areas to receive seeding or sodding.

3.05 PROTECTION

A. Protect landscaping and other features remaining as final work.

B. Protect existing structures.

C. Contractor is responsible for the establishment of grass throughout the site. For his/her convenience, Contractor should consider the use of matting material, sodding and other means to establish grass at sloped areas and areas where concentrated flows occur.

END OF SECTION 31 22 19

SECTION 31 23 13 SUBGRADE PREPARATION

PART 1 – GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM): D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft3 (600 kN-m/m3)).

1.02 DEFINITIONS

A. Optimum Moisture Content:. Soils should be moisture conditioned to between -3 and +3 percent of the optimum moisture content. Care should be taken to insure that the subgrade does not dry out or become saturated prior to pavement construction. Moisture conditioning is not required in exposed limestone subgrade areas.

A. Prepared Ground Surface: Ground surface after completion of clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and scarification and compaction of subgrade.

B. Subgrade: Layer of existing soil after completion of clearing, grubbing, scalping of topsoil prior to placement of fill, roadway structure or base for floor slab.

C. Proof-Rolling: Testing of subgrade by compactive effort to identify areas that will not support the future loading without excessive settlement.

1.03 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Sections 02 41 13, Selective Site Demolition; prior to subgrade preparation.

1.04 QUALITY ASSURANCE

A. Notify Engineer when subgrade is ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Prepare subgrade when unfrozen and free of ice and snow.

PART 2 – PRODUCTS

A. Not Used

PART 3 – EXECUTION

3.01 GENERAL

A. Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling.

B. Bring subgrade to proper grade and cross-section and uniformly compact surface.

C. Do not use sections of prepared ground surface as haul roads. Protect prepared subgrade from traffic.

D. Maintain prepared ground surface in finished condition until next course is placed.

3.02 COMPACTION

A. Under Earthfill: Three passes with three-wheeled power roller weighing approximately 10 tons.

B. Under Pavement Structure or curbs gutters and walks: Compact the upper 6 inches to minimum of 98 percent relative compaction as determined in accordance with ASTM D698.

3.03 MOISTURE CONDITIONING

A. Dry Subgrade: Add water, then mix to make moisture content uniform throughout.

B. Wet Subgrade: Aerate material by blading, discing, harrowing, or other methods, to hasten drying process.

3.04 TESTING

A. Proof-roll subgrade with equipment specified in Article Compaction to detect soft or loose subgrade or unsuitable material, as determined by Engineer.

3.05 CORRECTION

A. Soft or Loose Subgrade:

1. Adjust moisture content and recompact, or

2. Over excavate as specified in Section 31 22 13 Rough Grading, and replace with suitable material, as specified in Section 31 22 13 Rough Grading.

3. Unsuitable Material: Over excavate as specified in Section 31 22 13 Rough Grading, and replace with suitable material, as specified in Section 31 22 13 Rough Grading.

END OF SECTION 33 40 00

SECTION 31 23 33 TRENCHING AND BACKFILLING

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Include the following work in addition to items normally part of this Section:

1. Coordinate, excavate and backfill all trenching required for underground site drainage lines.

2. Provide necessary safety systems to comply with local and State laws. Refer to Section 31 41 33, Trench Shielding.

B. Unknown Utilities and Obstacles:

1. If any unknown and uncharted utilities are encountered during excavation, promptly notify Architect and wait for his instructions before proceeding.

2. If such unknown utilities are encountered and work is continued without contacting the Architect for instructions and damage is caused to said utilities, repair such damage to the satisfaction of the Owner at no additional cost to the Owner.

3. If any unforeseen major obstacle is encountered in excavation, the Owner will have a survey made to determine the course of action which will relieve the Contractor of undue expense.

1.02 Trench Excavation

A. Excavation in a paved street shall be preceded by saw cutting completely through any asphaltic cement concrete or Portland cement concrete surface, base, or subbase to the underlying subgrade. This requirement shall not apply to excavations made with trenching machines that use a rotating continuous belt or chain for cutting and removing of material.

B. Underground piped utilities shall be constructed in an open cut in accordance with Federal regulations, applicable State Statutes conforming to “Excavation Safety Systems" and with a trench width and depth described below. When pipe is to be constructed in fill above the natural ground, Contractor shall construct embankment to an elevation not less than one foot above the top of the pipe, after which trench is excavated. Required vertical sides shall be sheeted and braced as indicated to maintain the sides of the required vertical excavation throughout the construction period. Adequacy of the design of sheeting and bracing shall be the responsibility of the Contractor's design professional. The Contractor shall be responsible for installation as indicated. After the pipe has been laid and the backfill placed and compacted to 12 inches above the top of the pipe, any sheeting, shoring and bracing required may be removed with special care to insure that the pipe is not disturbed. As each piece of sheeting is removed, the space left by its removal must be thoroughly filled and compacted with suitable material and provisions made to prevent the sides of the trench from caving until the backfill has been completed. Any sheeting left in place will not be paid for and shall be included in the unit price bid for pipe.

1.03 Trench Width

A. Trenches for water, reclaimed, and wastewater lines shall have a clear width on each side beyond the outside surfaces of the pipe bell or coupling of not less than 6 inches nor more than 12 inches.

B. Trenches for Storm Sewers up to 42 inches shall have a width of 1 foot on each side beyond the outside surfaces of the pipe. Pipes more than 42 inches shall have a trench width not to exceed 18 inches on each side beyond the outside surfaces of the pipe.

C. If the trench width within the pipe zone exceeds this maximum, the entire pipe zone shall be refilled with approved backfill material, thoroughly compacted to a minimum of 95 percent of maximum density as determined by TxDOT Test Method Tex-114-E and then re-excavated to the proper grade and dimensions. Excavation along curves and bends shall be so oriented that the trench and pipe are approximately centered on the centerline of the curve, using short lengths of pipe

and/or bend fittings if necessary.

D. For all utilities to be constructed in fill above natural ground, the embankment shall first be constructed to an elevation not less than 1 foot above the top of the utility after which excavation for the utility shall be made.

1.04 Trench Depth and Depth of Cover

A. All pipe and in-line appurtenances shall be laid to the grades indicated. The depth of cover shall be measured from the established finish grade, natural ground surface, subgrade for staged construction, street or other permanent surface to the top or uppermost projection of the pipe.

B. Where not otherwise indicated, all potable/reclaimed water piping shall be laid to the following minimum depths:

1. Potable/reclaimed water piping installed in undisturbed ground in easements of undeveloped areas, which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 36 inches of cover.

2. Potable/reclaimed water piping installed in existing streets, roads or other traffic areas shall be laid with at least 48 inches of cover below finish grade.

C. Unless approved by the Engineer, installation of potable/reclaimed water piping in proposed new streets will not be permitted until paving and drainage plans have been approved and the roadway traffic areas excavated to the specified or standard paving subgrade, with all parkways and sidewalk areas graded according to any applicable provisions of the drainage plans or sloped upward from the curb line to the right-of-way line at a minimum slope of ¼ inch per foot. Piping and appurtenances installed in such proposed streets shall be laid with at least 36 inches of cover below the actual subgrade.

D. Where not otherwise indicated, all wastewater piping shall be laid to the following minimum depths:

E. Wastewater piping installed in natural ground in easements or other undeveloped areas, which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 42 inches of cover.

1. Wastewater piping installed in existing streets, roads or other traffic areas shall be laid with at least 66 inches of cover.

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2. Wastewater piping installed in such proposed streets shall be laid with at least 48 inches of cover below the actual subgrade.

1.05 Classification of Excavation

A. Excavation will not be considered or paid for as a separate item of Work, so excavated material will not be classified as to type or measured as to quantity. Full payment for all excavation required for the construction shall be included in the various unit or lump sum Contract prices for the various items of Work installed, complete in place. No extra compensation, special treatment or other consideration will be allowed due to rock, pavement, caving, sheeting and bracing, falling or rising water, working under and in the proximity of trees or any other handicaps to excavation.

1.06 Dewatering Excavation

A. Underground piped utilities shall not be constructed or the pipe laid in the presence of water. All water shall be removed from the excavation prior to the pipe placing operation to insure a dry firm granular bed on which to place the underground piped utilities and shall be maintained in such unwatered condition until all concrete and mortar is set. Removal of water may be accomplished by bailing, pumping or by a well-point installation as conditions warrant.

B. In the event that the excavation cannot be dewatered to the point where the pipe bedding is free of mud, a seal shall be used in the bottom of the excavation. Such seal shall consist of Class B concrete, with a minimum depth of 3 inches.

1.07 Trench Conditions

A. Before attempting to lay pipe, all water, slush, debris, loose material, etc., encountered in the trench must be pumped or bailed out and the trench must be kept clean and dry while the pipe is laid and backfilled. Where needed, sump pits shall be dug adjoining the trench and pumped as necessary to keep the excavation dewatered.

B. Backfilling shall closely follow pipe laying so that no pipe is left exposed and unattended after initial assembly. All open ends, outlets or other openings in the pipe shall be protected from damage and shall be properly plugged and blocked watertight to prevent the entrance of trench water, dirt, etc. The interior of the pipeline shall at all times be kept clean, dry and unobstructed.

C. Where the soil encountered at established footing grade is a quicksand, saturated or unstable material, the following procedure shall be used unless other methods are indicated:

D. All unstable soils shall be removed to a depth of a minimum 2 feet below bottom of piped utility or as required to stabilize the trench foundation. Such excavation shall be carried out for the entire trench width.

E. All unstable soil so removed shall be replaced with a concrete seal, foundation rock or coarse aggregate materials placed across the entire trench width in uniform layers not to exceed 6 inches, loose measure and compacted by mechanical tamping or other means which shall provide a stable foundation for the utility.

F. Forms, sheathing and bracing, pumping, additional excavation and backfill required in unstable trench conditions shall be included in the unit price bid for pipe.

1.08 Blasting

A. All blasting shall conform to the provisions of the "General Conditions" and/or "Public Safety and Convenience".

1.09 Removing Old Structures

A. When out of service masonry structures or foundations are encountered in the excavation, such obstructions shall be removed for the full width of the trench and to a depth of 1 foot below the bottom of the trench. When abandoned inlets or manholes are encountered and no plan provision is made for adjustment or connection to the new sewers, such manholes and inlets within the construction limits shall be removed completely to a depth 1 foot below the bottom of the trench. In each instance, the bottom of the trench shall be restored to grade by backfilling and compacting by the methods provided above. Where the trench cuts through storm or wastewater sewers which are known to be abandoned, these sewers shall be cut flush with the sides of the trench and blocked with a concrete plug in a manner satisfactory to the E/A. When old structures are encountered, which are not visible from the existing surface and are still in service, they shall be protected and adjusted as required to the finished grade.

1.10 Lines and Grades

A. Grades, lines and levels shall conform to the General Conditions and/or "Grades, Lines and Levels". Any damage to the above by the Contractor shall be re-established at the Contractor's expense. The Contractor shall furnish copies of all field notes and "cut sheets" to the Engineer and the City.

B. The location of the lines and grades indicated may be changed only by direction of the Engineer. It is understood that the Contractor will be paid for Work actually performed on the basis of the unit Contract prices and that the Contractor shall make no claim for damages or loss of anticipated profits due to the change of location or grade.

C. All necessary batter boards or electronic devices for controlling the Work shall be furnished by, and at the expense of, the Contactor. Batter boards shall be of adequate size material and shall be supported substantially. The boards and all location stakes must be protected from possible damage or change of location. The Contractor shall furnish good, sound twilled lines for use in achieving lines and grades and the necessary plummets and graduated poles.

D. The Contractor shall submit to the Engineer at least 6 copies of any layout Drawings from the pipe manufacturer for review and approval. The Contractor shall submit the layout Drawings at least 30 days in advance of any actual construction of the project. The Engineer will forward all comments of the review to the Contractor for revision. Revisions shall be made and forwarded to the E/A for his acceptance. Prior to commencement of the Project, reviewed layout Drawings will be sent to the Contractor marked for construction.

E. Should the Contractor's procedures not produce a finished pipe placed to grade and alignment, the pipe shall be removed and relayed and the Contractors procedures modified to the satisfaction of the Engineer. No additional compensation shall be paid for the removal and relaying of pipe required above.

1.11 Surplus Excavated Materials

A. Excess material or material which cannot be made suitable for use in embankments will be declared surplus by the Engineer and shall become the property of the Contractor to dispose of off-site at a permitted fill site, without liability to the Owner or any individual. Such surplus material shall be removed from the Work site promptly following the completion of the portion of the utility involved.

1.12 INSTALLATION CONFERENCE

A. Contact the Engineer with at least 48 hours notice to meet with subcontractors before utility installation.

1.13 QUALITY ASSURANCE

A. Inspection and Testing Laboratory Services - Test results shall meet or exceed the standards referenced.

B. Refer to Geotechnical Report and Civil Drawings.

PART 2 - MATERIALS

2.01 BACKFILL MATERIAL

A. Excavated material may be reused for backfill provided it is suitable for compaction, with the following exception:

1. When backfill is to be covered with a concrete building slab, the backfill shall be specified select fill specified in Section 33 00 00, Earthwork and compacted in layers to specified depth.

B. Backfill of trenches under pavement as indicated on Civil Drawings, or if not indicated, with cement stabilized sand (1-1/2 sacks of Portland cement per ton of sand mixture) in eight (8) inch lifts to within six (6) inches of pavement surface, unless shown otherwise on Civil Drawings or directed otherwise by Engineer. Complete the backfill with the specified select fill material. Compact each layer of cement stabilized sand to 95 percent density in accordance with ASTM D698, unless shown otherwise on Civil Drawings or directed otherwise by Architect. Refer to Civil Drawings for specific requirements regarding sewer lines.

C. Select Backfill or Borrow

1. This material shall consist of borrow or suitable material excavated from the trench. It shall be free of stones or rocks over 8 inches and shall have a plasticity index of less than 20. The moisture content at the time of compaction shall be within 2 percent of optimum as determined by TxDOT Test Method Tex-114-E. Sandy loam borrow will not be allowed unless shown on the Drawings or authorized by the E/A.

2. All suitable materials from excavation operations not required for backfilling the trench may be placed in embankments, if applicable. All unsuitable materials that cannot be made suitable shall be considered surplus excavated materials as described in 1.11. The Contractor may, if approved by the engineer, modify unsuitable materials to make them suitable for use. Modification may include drying, removal or crushing of over-size material, and lime or cement treatment.

D. Cement Stabilized Backfill

1. When indicated or directed by the Engineer, all backfill shall be with cement-stabilized backfill rather than the usual materials. Unless otherwise indicated, cement stabilized backfill material shall consist of a mixture of the dry constituents described for Class J Concrete. The cement and aggregates shall be thoroughly dry mixed with no water added to the mixture except as may be directed by the Engineer.

2.02 BEDDING MATERIALS

A. Pipe shall be installed in a continuous bedding envelope of the type shown on the drawings or as described herein. The envelope shall extend the full trench width, to a depth of at least 6 inches (150 mm) below the pipe and to a depth of the springline of storm water pipe and at least 12 inches (300 mm) above water, reclaimed, and wastewater pipe.

USE/PIPE MATERIAL	Cement Stabilized Backfill	Natural or Mf'd Sand	Pea Gravel	PIPE BEDDING STONE			
				Uncrushed Gravel	Crushed Gravel	Crushed Stone	Stone Screenings
WATER and RECLAIMED WATER							
Welded Steel	X					X	
Service Tubing ¾" to 2½"		X	X				X
WATER and RECLAIMED WATER (Ductile Iron)							
Up to 15 Inch ID		X	X	X			X
Larger Than 15 Inch ID			X	X			
WATER and RECLAIMED WATER (PVC only) and WASTEWATER							
Up to 15 Inch ID		X	X	X	X	X	X
Larger Than 15 Inch ID			X	X	X	X	
STORMWATER							
Concrete		X	X	X	X	X	X
Metal		X	X	X			X

B. General requirements and limitations governing bedding selection.

1. Crushed gravel or crushed stone shall not be used with polyethylene tubing or polyethylene film wrap.

2. Uncrushed gravel may be used with polyethylene film wrap in trenches up to 6 feet deep and in deeper trenches where ample trench width, a tremmie, or conditions will allow controlled placement of the gravel without damaging the polyethylene wrap.

3. Bedding shall be placed in lifts not exceeding 8 inches loose thickness and compacted thoroughly to provide uniform support for the pipe barrel and to fill all voids around the pipe.

4. Pea Gravel or bedding stone shall be used in blasted trenches.

C. Requirements to prevent particle migration.

1. Bedding material shall be compatible with the materials in the trench bottom, walls and backfill so that particle migration from, into or through the bedding is minimized. The Engineer may require one or more of the following measures to minimize particle migration: use of impervious cut-off collars; selected bedding materials, such as pea gravel or bedding stone mixed with sand; filter fabric envelopment of the bedding; cement stabilized backfill; or other approved materials or methods. Measures to minimize particle migration will be shown on the Drawings or designated by the E/A, and, unless provisions for payment are provided in the contract documents, the cost of these measures shall be agreed by change order. The following limitations shall apply.

2. Sand, alone, shall not be used in watercourses, in trenches where groundwater is present, or in trenches with grades greater than 5 percent.

3. Pea gravel or bedding stone, alone, shall not be used in the street right-of-way within 5 feet of subgrade elevation in trenches that are 3 feet or wider.

4. Each gravel or bedding stone, alone, shall not be used where the trench bottom, sides, or backfill is composed of non-cementitious, silty or sandy soils having plasticity indices less than 20, as determined by the Engineer.

5. Sand, alone, shall not be used for installation of concrete storm water pipe unless the bedding envelope is wrapped with a geotextile membrane and the joints of the stormdrain conduit are wrapped to prevent the migration of fines into the bedding envelope and into the stormdrain conduit.

6. For concrete storm water pipe, if pea gravel, uncrushed gravel, crushed gravel, crushed stone, or combination thereof is used for pipe bedding material, a geotextile filter fabric shall be placed around the perimeter of the joint.

D. Clay Plugs

1. Clay plugs shall be used at all underground pipe entrances to buildings. The plug shall extend 5' out from the face of the building or 5' out from the face of select fill pad under the building. There shall be no bedding material in the clay plug area. No joint shall be made closer than 5' from the clay plug. No joint shall be made inside the clay plug.

PART 3 - EXECUTION

3.01 TRENCHING

A. Excavate trenches to required depths, slope and grade.

B. Remove mud and other unstable soil encountered in trench bottom to firm bearing and backfill with sand to proper grade and compact to uniform firm support for the bottom of the raceways and duct banks.

C. In the event rock is encountered, excavate six (6) inches below required depth and backfill to required depth with sand to proper grade and compact to uniform firm support.

D. Make full and complete repair of streets, roadways, and walks which have been cut, with materials of like nature to those cut away.

E. Exercise care for the safety of employees, materials and equipment in or near trenches or other excavations. Comply with trenching requirements of authorities having jurisdiction.

3.02 BACKFILLING

A. Notify Engineer before backfilling occurs.

B. Do not backfill trenches until all required tests, if any, and inspections have been made on drainage lines installed.

C. Place specified backfill material, to a depth of one (1) foot above top of drainage line and compact to 95 percent maximum density.

D. Backfill the remainder of the trench in eight (8) inch lifts and compact as shown on Civil Drawings or required to achieve density of soil of surrounding area.

E. Backfill will not be accepted under any lines inadvertently excavated too deep.

3.03 GENERAL BACKFILLING

A. Backfill shall be as shown on the plans. Place in 6-inch maximum loose lifts to one foot above pipe unless otherwise specified. Bring up evenly on each side, and for the full length of the structure. Ensure that no damage is done to structures or protective coatings thereon. Place the remainder of the backfill in 8-inch maximum loose lifts unless

otherwise specified. Compact each loose lift as specified in Paragraph "General Compaction" before placing the next lift. Where unacceptable settlements occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation.

B. No backfill shall be placed until the line has been inspected and approved for backfilling.

3.04 GENERAL COMPACTION

A. Use hand-operated plate type vibratory or other suitable hand tampers in areas not accessible to larger rollers or compactors. Be careful to avoid damaging pipes and protective pipe coatings. Compaction shall be in accordance with the following unless otherwise specified. If necessary, the Contractor's selected equipment and construction procedure shall be altered, changed or modified in order to meet the specified compaction requirements.

B. Initial backfill and bedding shall be carefully packed under the haunches of the pipe and brought up simultaneously on both sides so as to obviate any displacement of the pipe from its true alignment. Bedding shall be compacted in layers not more than eight (8) inches in thickness in a manner that will preclude moving the pipe, to not less than 95% of maximum dry density as determined by the procedure set forth in ASTM Designation D1557. Jetting of backfill material will not be permitted.

C. Select backfill above the initial backfill shall be placed in loose lifts not exceeding eight (8) inches in thickness before compaction, and compacted by the use of pneumatic tampers or other mechanical means approved. Water or dry, as required, to bring the soils as close as practicable to the optimum moisture content for proper compaction. Compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive displacement or may damage the pipeline will not be permitted. Lifts of backfill shall be compacted to not less than 95% of maximum dry density as determined by the procedure set forth in ASTM Designation D1557. Jetting of backfill material will not be permitted.

3.05 TESTING LABORATORY SERVICES

A. Backfill will be inspected and tested by the Geotechnical Engineer during placement. Contractor shall cooperate with the Engineer and shall provide working space for such tests in his operations. Backfill not compacted in accordance with these specifications shall be recompacted, or removed as necessary and replaced to meet specified requirements prior to proceeding with the work.

END OF SECTION 31 23 33

SECTION 31 25 00 EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.01 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

B. ASTM INTERNATIONAL (ASTM)

1. ASTM D 4439(2004) Geosynthetics

2. ASTM D 4491 (1999a; R 2009) Water Permeability of Geotextiles by Permittivity

3. ASTM D 4533 (2004; R 2009) Trapezoid Tearing Strength of Geotextiles

4. ASTM D 4632 (2008) Grab Breaking Load and Elongation of Geotextiles

5. ASTM D 4751 (2004) Determining Apparent Opening Size of a Geotextile

6. ASTM D 4873 (2002; R 2009) Identification, Storage, and Handling of Geosynthetic Rolls and Samples

C. U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

1. EPA 832-R-92-005 (1992) Storm Water Management for Construction Activities Developing Pollution Preventions and Plans and Best Management Practices

D. U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

1. 40 CFR 122.26 Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)

E. TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ)

1. Texas General Permit TXR150000

1.02 SYSTEM DESCRIPTION

A. The work consists of implementing the storm water pollution prevention measures to prevent sediment from entering streams or water bodies as specified in this Section in conformance with the requirements of the requirements of the National Pollutant Discharge Elimination System (NPDES) and the Texas commission on Environmental Quality TCEQ Texas General Permit.

1.03 EROSION AND SEDIMENT CONTROLS

The controls and measures required of the Contractor are described below.

A. Stabilization Practices

1. The stabilization practices to be implemented include temporary seeding, mulching, geotextiles, sod stabilization, vegetative buffer strips, erosion control matts, protection of trees, preservation of mature vegetation, etc. On the daily CQC Report, record the dates when the major grading activities occur, (e.g., clearing and grubbing, excavation, embankment, and grading); when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS, initiate stabilization practices as soon as practicable, but no more than 14 days, in any portion of the site where

construction activities have temporarily or permanently ceased.

B. Unsuitable Conditions

1. Where the initiation of stabilization measures by the fourteenth day after construction activity temporarily or permanently ceases or is precluded by unsuitable conditions caused by the weather, initiate stabilization practices as soon as practicable after conditions become suitable.

C. No Activity for Less Than 21 Days

1. When the total time period in which construction activity is temporarily ceased on a portion of the site is 21 days minimum, stabilization practices do not have to be initiated on that portion of the site until 14 days have elapsed after construction activity temporarily ceased.

D. Burnoff

1. Burnoff of the ground cover is not permitted.

E. Protection of Erodible Soils

1. Immediately finish the earthwork brought to a final grade, as indicated or specified, and protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

F. Erosion, Sediment and Stormwater Control

1. Provide a Storm Water Notice of Intent for NPDES coverage under the general permit for construction activities and a Storm Water Pollution Prevention Plan (SWPPP) for the project to the Engineer and Owner prior to the commencement of work. The SWPPP shall meet the requirements of the EPA and the State of Texas general permit for storm water discharges from construction sites. Submit the SWPPP along with any required Notice of Intents, Notice of Termination, and appropriate permit fees, via the Owner, to the appropriate State agency for approval, a minimum of 14 calendar days prior to the start of any land disturbing activities. Maintain an approved copy of the SWPPP at the construction on-site office, and continually update as regulations require, to reflect current site conditions. Include within the SWPPP:

   a. Identify potential sources of pollution which may be reasonably expected to affect the quality of storm water discharge from the site.

   b. Describe and ensure implementation of practices which will be used to reduce the pollutants in storm water discharge from the site.

   c. Ensure compliance with terms of the EPA and or the State of Texas general permit for storm water discharge.

   d. Select applicable best management practices from EPA 832-R-92-005.

   e. Include a completed copy of the Registration Statement, BMP Inspection Report Template and Notice of Termination except for the effective date.

2. Following SWPPP approval, submit Registration Statement and appropriate permit fees to the Texas Commission on Environmental Quality (TCEQ) before any land disturbing activities begin. Coverage under the permit begins on the day the Registration Statement and fee are:

   a. post marked by mail,

   b. registered online at the TCEQ's website, or

c. hand delivered to the TCEQ's office. The Contractor is responsible for all associated fees; contact TCEQ to determine applicable fees.

3. Install, inspect, and maintain best management practices (BMPs) as required by the general permit. Prepare and submit to TCEQ, BMP Inspection Reports as required by the general permit.

4. Once construction is complete and the site has been stabilized with a final, sustainable cover, submit the Notice of Termination to TCEQ within 30 days after all land disturbing activities end.

5. At the time of submittal to TCEQ, concurrently forward copies of the SWPPP, Registration Statement, BMP Inspection Reports, and Notice of Termination to the OWNER, and to engineer.

6. Information on the permit application, SWPPP requirements, Registration Statement, BMP Inspection Reports, and Notice of Termination can be found in the Texas Administrative Code TAC 30 Part 1. The Registration Statement, Notice of Termination, and permit fee forms can be found on the TCEQ's website http://www.tceq.texas.gov/permitting/stormwater/sw_permits.html This website also contains the permit regulations and information on how to obtain coverage online.

7. Once construction is complete and the site has been stabilized with a final, sustainable cover, submit the Notice of Termination to TCEQ within 30 days after all land disturbing activities end.

G. Stormwater Drainage

1. There will be no discharge of excavation ground water to the sanitary sewer, storm drains, or to any creek, estuary or river without prior specific authorization of the TCEQ in writing. Discharge of hazardous substances will not be permitted under any circumstances. Construction site runoff will be prevented from entering any storm drain or any creek, river or estuaries directly by the use of silt fence or other method suitable to the Engineer. Provide erosion protection of the surrounding soils.

H. Structural Practices

1. For common drainage locations that serve a disturbed area of 10 or more acres at one time, provide a temporary or permanent detention basin providing 3,600 cubic feet of storage per acre drained, or equivalent control measures, where attainable until stabilization of the site. 3,600 cubic feet of storage per acre drained does not apply to flows from offsite areas and flows from onsite areas that are either undisturbed or have undergone final stabilization where such flows are diverted around the sediment basin. For drainage locations which serve a disturbed area of 4 or more hectares (10 or more acres) at one time and where a temporary sediment basin providing 3,600 cubic feet of storage per acre drained, or equivalent sediment controls, is not attainable, sediment controls are required for all sideslope and downslope boundaries of the construction area.

2. For drainage locations serving less than 10 acres, sediment traps, silt fences, or equivalent sediment controls are required for all sideslope and downslope boundaries of the construction area unless a sediment basin providing storage for 3,600 cubic feet of storage per acre drained is provided.

3. Implement structural practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement structural practices in a timely manner, during the construction process, to minimize erosion and sediment runoff. Include the following devices; Silt Fences and Rock Berms Location and details of installation and construction are shown on the drawings

I. Silt Fences

1. Provide silt fences as a temporary structural practice to minimize erosion and sediment runoff. Properly install silt fences to effectively retain sediment immediately after completing each phase of work where erosion would occur in the form of sheet and rill erosion (e.g. clearing and grubbing, excavation, embankment, and grading).

Install silt fences in the locations indicated on the drawings. Obtain approval from the Engineer prior to final removal of silt fence barriers.

J. Rock Berms

1. Provide Rock Berms as a temporary structural practice to minimize erosion and sediment runoff. If rock berms are used, properly place the berms to effectively retain sediment immediately after completing each phase of work (e.g., clearing and grubbing, excavation, embankment, and grading) in each independent runoff area (e.g., after clearing and grubbing in an area between a ridge and drain, place the berms as work progresses, remove/replace/relocate the berms as needed for work to progress in the drainage area). Location and details of rock berms are shown on the drawings. The Engineer will approve the final removal of straw bale barriers. Provide rows of berms of straw as follows:

   a. Along the downhill perimeter edge of all areas disturbed.

   b. Along the top of the slope or top bank of drainage ditches, channels, swales, etc. that traverse disturbed areas.

   c. Along the toe of all cut slopes and fill slopes of the construction areas.

   d. Perpendicular to the flow in the bottom of existing drainage ditches, channels, swales, etc. that traverse disturbed areas or carry runoff from disturbed areas. Space the rows as shown on the drawings.

   e. Perpendicular to the flow in the bottom of new drainage ditches, channels, and swales. Space the rows as shown on the drawings.

   f. At the entrance to culverts that receive runoff from disturbed areas.

K. Diversion Dikes

1. Build diversion dikes with a maximum channel slope of 2 percent and adequately compacted to prevent failure. The minimum height measured from the top of the dike to the bottom of the channel shall be 18 inches. The minimum base width shall be 6 feet and the minimum top width shall be 2 feet. Ensure that the diversion dikes are not damaged by construction operations or traffic. Locate diversion dikes where shown on the drawings.

L. Sediment Basins

Trap sediment in permanent sediment basins. Rough grading sedimentation filtration ponds and or detention ponds to act as a temporary sediment trap during construction. Pump dry and remove the accumulated sediment, after each storm. Use a paved weir or vertical overflow pipe for overflow. Remove collected sediment from the site. Institute effluent quality monitoring programs. Install, inspect, and maintain best management practices (BMPs) as required by the general permit. Prepare BMP Inspection Reports as required by the general permit. If required by the permit, include those inspection reports.

M. Vegetation and Mulch

1. Provide temporary protection on sides and back slopes as soon as rough grading is completed or sufficient soil is exposed to require erosion protection. Protect slopes by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Stabilize slopes by hydroseeding, anchoring mulch in place, covering with anchored netting, sodding, or such combination of these and other methods necessary for effective erosion control.

2. Seeding: Provide new seeding where ground is disturbed. Include topsoil or nutriment during the seeding operation necessary to establish or reestablish a suitable stand of grass. The seeding operation will be as

specified in Section 32 92 19 SEEDING.

N. Triangular Sediment Filter dikes

Provide Triangular Sediment filter dikes to intercept and detain water-borne sediment from unprotected area of limited extent. The triangular sediment filter dike us used where there is no concentration of water in a channel or other drainage way above the barrier and the contributing drainage area is less than one acre. If the uphill slope above the dike exceeds 10%, the length of the slope above the dike should be less than 50 feet. If concentrated flow occurs after installation, corrective action should be taken such as placing rock berm in the areas of concentrated flow. This measure is effective on paved areas where installation of silt fence is not possible or where vehicle access must be maintained.

1.04 SUBMITTALS

A. Submit the following in accordance with Section 01 33 00 SUBMITTALS:

1. Preconstruction Submittals

a. Storm Water Pollution Prevention Plan

b. Storm Water Notice of Intent

c. Pollution prevention plan and Notice of intent for NPDES coverage under the general permit for construction activities

2. Test Reports

a. Storm Water Inspection Reports for General Permit

b. Erosion and Sediment Controls

3. Certificates

a. Mill Certificates or Affidavits

b. Certificate attesting that the Contractor has met all specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Identify, store and handle filter fabric in accordance with ASTM D 4873

PART 2 – PRODUCTS

2.01 COMPONENTS FOR SILT FENCES

A. Filter Fabric

1. Provide geotextile that complies with the requirements of ASTM D 4439 , and material should be polypropylene, polyethylene or polyamide woven or nonwoven fabric. The fabric width should be 36 inches, with a minimum unit weight of 4.5 oz/yd, mullen burst strength exceeding 190 lb/in2, ultraviolet stability exceeding 70%, and minimum apparent opening size of U.S. Sieve No. 30

2. . The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile Elongation (percent)	ASTM D 4632	445 N 100 lbs.min. 30 percent max.
Trapezoid Tear	ASTM D 4533	245 N min. 55 lbs. min.
Permittivity	ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D 4751	30

B. Silt Fence Posts and woven wire backing

1. Fence posts should be made of hot rolled steel, at least 4 feet long with Tee or Y-bar cross section, surface painted or galvanized, minimum nominal weight 1.25 lb/ft2, and Brindell hardness exceeding 140.
2. Woven wire backing to support the fabric should be galvanized 2" x 4" welded wire, 12 gauge minimum.

C. Mill Certificate or Affidavit

1. Provide a mill certificate or affidavit attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. Specify in the mill certificate or affidavit the actual Minimum Average Roll Values and identify the fabric supplied by roll identification numbers. Submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

2.02 COMPONENTS FOR ROCK BERMS

A. The berm shall be secured with a woven wire sheathing having maximum opening of 1" and minimum wire diameter of 20 gauge galvanized and should be secured with shoat rings.

B. clean open graded 3 to 5 inch diameter rock should be used, except in areas where high velocities or large volumes of flow are expected, where 5 to 8 inch diameter rock may be used.

2.03 COMPONENTS FOR TRIANGULAR SEDIMENT FILTER DIKES

A. Silt fence material should be polypropylene, polyethylene or polyamide woven or nonwoven fabric. The fabric width should be 36 inches, with a minimum unit weight of 4.5 oz/yd, mullen burst strength exceeding 190 lbs/in^2, ultraviolet stability exceeding 70%, and a minimum apparent opening site of U.S. Sieve No. 30.

B. The dike structure should be 6 gauge 6” x 6” wire mesh folded into triangular form being eighteen (18) inches on each side.

PART 3 - EXECUTION

3.01 INSTALLATION OF SILT FENCES

A. Steel posts, which support the silt fence, should be installed on a slight angle toward the anticipated runoff source. Post must be embedded a minimum of 1- foot deep and spaced not more than 8 feet on center. Where water concentrates, the maximum spacing should be 6 feet.

B. Lay out fencing down-slope of disturbed area, following the contour as closely as possible. The fence should be sited so that maximum drainage is 1/4 acre/100 feet of fence.

C. The toe of the silt fence should be trenched in with a spade or mechanical trencher, so that the down-slope face of the trench is flat and perpendicular to the line of flow. Where fence cannot be trenched in (e.g., pavement or rock outcrop), weight fabric flap with 3 inches of pea gravel on uphill side to prevent flow from seeping under fence.

D. The trench must be a minimum of 6 inches deep and 6 inches wide to allow for the silt fence fabric to be laid in the ground and backfilled with compacted material.

E. Silt fence should be securely fastened to each steel support post or to woven wire, which is in turn attached to the steel fence post. There should be a 3-foot overlap, securely fastened where ends of fabric meet.

F. Silt fence should be removed when the site is completely stabilized so as not to block or impede storm flow or drainage.

3.02 INSTALLATION OF ROCK BERMS

A. Layout the woven wire sheathing perpendicular to the flow line. The sheathing should be 20 gauge woven wire mesh with 1 inch opening.

B. Berm should have a top width of 2 feet minimum with side slopes being 2:1 (H:V) or flatter.

C. Place the rock along the sheathing as shown in the diagram (figure 1.29 of TCEQ Publication RG-348) to a height not less than 18".

D. Wrap the wire sheathing around the rock and secure with tie wire so that the end of sheathing overlap at least 2 inches, and the berm retains its shape wen walked upon.

E. Berm should be built along the contour at zero percent grade or as near as possible.

F. The end of the berm should be tied into existing upslope grade and the berm should be buried in a trench approximately 3 to 4 inches deep to prevent failure of the control.

3.03 INSTALLATION OF TRIANGULAR SEDIMENT FILTER DIKES

A. As shown in the diagram the frame should be constructed of 6" x 6", 6gauge welded wire mesh, 18 inches per side, and wrapped with geotextile fabric the same composition as that used for silt fences.

B. Filter materials should overlap ends 6 inches to cover dike to dike Junction. Each junction should be secured by shoat rings.

C. There are several options for fastening the filter dike to the ground as shown in the drawings. The fabric skirt may be towed in with 6 inches of compacted material, or 12 inches of the fabric skirt should extend uphill and be secured with a minimum of 3 inch is of open graded rock, or with staples or nails. If these two options are not feasible Dike structure may be trenched in.

D. Triangular sediment filter dikes should be installed across exposed slopes during construction with the ends of the Dike tied into existing grades to prevent failure and should intercept no more than 1 acre of runoff.

E. When moved to allow vehicular access, the dikes should be reinstalled as soon as possible, but always at the end of the workday.

3.04 FIELD QUALITY CONTROL

A. Maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. Use the following procedures to maintain the protective measures.

1. Silt Fence Maintenance

a. Inspect the silt fences in accordance with paragraph, titled "Inspections," of this section. Any required repairs shall be made promptly. Pay close attention to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, replace the fabric promptly. Remove sediment deposits when deposits reach one-third of the height of the barrier. Remove a silt fence when it is no longer required. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade. The areas disturbed by this shaping shall receive erosion control or be seeded in accordance with Section 32 90 00 LANDSCAPE PLANTING.

b. Inspect all fencing weekly, and after any rainfall.

c. Remove sediment when buildup reaches 6 inches.

d. Replace any torn fabric or install a second line of fencing parallel to the torn section.

e. Replace or repair any sections crushed or collapsed in the course of construction activity. If a section of fence is obstructing vehicular access, consider relocating it to a spot where it will provide equal protection, but will not obstruct vehicles. A triangular filter dike may be preferable to a silt fence at common vehicle access points.

f. When construction is complete, the sediment should be disposed of in a manner that will not cause additional siltation and the prior location of the silt fence should be revegetated. The ence itself should be disposed of in an approved landfill.

2. Rock Berm Maintenance

a. Inspect rock berms in accordance with paragraph, titled "Inspections". Pay close attention to the repair of damaged berm, end runs and undercutting beneath berms. Accomplish necessary repairs to barriers or replacement of berms in a promptly manner. Remove sediment deposits when deposits reach one-half of the height of the barrier. At the each end of each row turn berms uphill when used to retain sediment. Remove a rock berm when it is no longer required. The immediate area occupied by the berms and any sediment deposits shall be shaped to an acceptable grade. Seed the areas disturbed by this shaping in accordance with Section 32 92 13 HYDROMULCH SEEDING AND SODDING.

b. Inspection should be made weekly and after each rainfall by the responsible part. For installations in streambed, additional daily inspection should be made.

c. Remove sediment and other debris when buildup reaches 6 inches and dispose of the accumulated silt of in an approved manner.

d. Repair any loose wire sheathing

e. The berm should be reshaped as needed during inspection

f. The berm should be replaced when the structure ceases to function as intended due to silt accumulation among the rocks, washout, construction traffic damage , etc.

g. The rock berm should be left in place until all upstream areas area stabilized and accumulated silt removed.

h.

3. Diversion Dike Maintenance

a. Inspect diversion dikes in accordance with paragraph, titled "Inspections," of this section. Pay close attention to the repair of damaged diversion dikes and accomplish necessary repairs promptly. When diversion dikes are no longer required, shape to an acceptable grade. Seed the areas disturbed by this shaping in accordance with Section 32 92 1 SEEDING.

4. Triangular Sediment filter Dike Maintenance

a. Inspection should be made weekly or after each rainfall event and repair or replacement should be made promptly as needed by the contractor.

b. Inspect and realign berms as needed to prevent gaps between sections

c. Accumulated silt should be removed after each rainfall, and disposed of in a manner which will not cause additional siltation.

d. After the site is completely stabilized, the dikes and any remaining silt should be removed. Silt should be disposed of in a manner that will not contribute to additional siltation.

3.05 INSPECTIONS

A. General

1. Inspect disturbed areas of the construction site, areas that have not been finally stabilized used for storage of materials exposed to precipitation, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every seven (7) calendar days and within 24 hours of the end of any storm that produces 0.5 inches or more rainfall at the site. Conduct inspections at least once every month where sites have been finally stabilized.

B. Inspections Details

Inspect disturbed areas and areas used for material storage that are exposed to precipitation for evidence of, or the potential for, pollutants entering the drainage system. Observe erosion and sediment control measures identified in the Storm Water Pollution Prevention Plan to ensure that they are operating correctly. Inspect discharge locations or points to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Inspect locations where vehicles exit the site for evidence of offsite sediment tracking.

C. Inspection Reports

For each inspection conducted, prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Storm Water Pollution Prevention Plan, maintenance performed, and actions taken. Furnish the report to the Owner within 24 hours of the inspection as a part of the Contractor's daily CQC REPORT. A copy of the inspection report shall be maintained on the job site.

END OF SECTION 31 25 00

SECTION 31 41 33 TRENCH SHIELDING

PART 1 - GENERAL

Drawings and general provisions of Contract, as well as all the appropriate specification sections of Division 1, apply to work of this section.

1.01 SECTION INCLUDES

A. Trench excavation requirements for the protection and safety of personnel.

1.02 RELATED SECTIONS

A. Section 31 11 01 - Site Preparation.

B. Section 31 22 13 - Rough Grading.

C. Section 33 11 00 – Water Utility Distribution Piping.

D. Section 33 41 00 – Storm Utility Drainage Piping.

E. Section 33 31 00 – Sanitary Utility Sewerage Piping

F. Section 31 22 19 - Finish Grading.

1.03 REFERENCES

A. United States Department of Labor Rules 29 CFR, Part 1926, Occupational Safety and Health Act, Subpart P.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Prior to award of contract, Contractor shall submit to Owner a Trench Safety System Plan sealed by a Professional Engineer registered in the State of Texas for inclusion into the contract. The Trench Safety System Plan, as a minimum, shall conform to the Occupational Safety and Health Standards and Interpretations "Subpart P-Excavations", Paragraphs 1926.650 through 1926.652 with Appendix A through F inclusive, and shall have the same force and effect as if bound or copied directly into the Technical Specifications. The Contractor shall be responsible for obtaining the necessary geotechnical information to design the Trench Safety System Plan.

B. The Trench Safety System Plan shall include a plan or other designation of areas in which each type of system is to be used, including length of trench to be opened, length of time trench to remain open, means of egress, storage of materials, allowable loads on trench walls, methods for filling/compacting bedding/backfill within the safety of the system, removal of system and equipment restrictions. The Trench Safety System Plan shall also include drawings or manufacturer's data describing the various element of the Trench Safety System Plan with sufficient detail for Contractor's workers to properly install Trench Safety System.

C. Sealed engineering calculations and/or equipment manufacturer's certifications, showing that the system is designed to withstand anticipated loadings and can be fully installed in designated spaces.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall strictly observe the pertinent portions (as they may apply to the jobsite conditions) of prepared

Trench Safety System Plan as well as all of the latest provisions of the Occupational Safety and Health Standards and Interpretations "Subpart P-Excavations", Paragraphs 1926.650 through 1926.652 with Appendix A through F inclusive, and shall have the same force and effect as if bound or copied directly into the Technical Specifications. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO FAMILIARIZE HIMSELF/HERSELF WITH ALL OF THE REQUIREMENTS OF THE TRENCH SAFETY SYSTEM PLAN AND TO STRICTLY ADHERE TO ALL OF THEM. The cost for all shoring, sheeting, bracing, sloping, etc. for excavation and trench safety shall be included in the Contractor's bid.

B. Brace, sheet and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind, whether on public or private property, will be fully protected from damage.

C. In the event of damage to such improvements, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the owner.

D. Arrange bracing, sheeting, and shoring so as to not place stress on any portion of the completed Work until the general construction thereof has proceeded far enough to provide sufficient strength.

E. Removal of trench bracing: Exercise care in the drawing removal of sheeting, shoring, bracing, and timbering to prevent collapse and caving of the excavation faces being supported.

END OF SECTION 31 41 33

SECTION 32 11 23 AGGREGATE BASE COURSE

PART 1 – GENERAL

1.01 DESCRIPTION:

This specification shall govern for all work necessary to provide the base course (limestone) on the previously prepared subgrade (or sub-base) required to complete the project. This specification is a performance specification and the performance of the completed work is the responsibility of the Contractor.

1.02 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

1. AASHTO T 180 (2010) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop

2. AASHTO T 224 (2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

C. ASTM INTERNATIONAL (ASTM)

1. ASTM C117 (2013) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing

2. ASTM C127 (2012) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate

3. ASTM C128 (2012) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate

4. ASTM C131 (2006) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

5. ASTM C136 (2006) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

6. ASTM D1556 (2007) Density and Unit Weight of Soil in Place by the Sand-Cone Method

7. ASTM D1557 (2012) Standard Test Methods for Laboratory Compaction Characteristics of

8. Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)

9. ASTM D2487 (2011) Soils for Engineering Purposes (Unified Soil Classification System)

10. ASTM D4318 (2010) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

11. ASTM D5821 (2001; R 2006) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate

12. ASTM D6938 (2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

13. ASTM D75/D75M (2009) Standard Practice for Sampling Aggregates

14. ASTM E11 (2009; E 2010) Wire Cloth and Sieves for Testing Purposes

1.03 DEFINITIONS

A. For the purposes of this specification, the following definitions apply.

1. Aggregate Base Course

a. Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

B. Degree of Compaction

a. Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum dry density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve are expressed as a percentage of the laboratory maximum dry density in accordance with AASHTO T 180 Method D and corrected with AASHTO T 224.

1.04 SYSTEM DESCRIPTION

A. All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Provide adequate equipment having the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth

1.05 SUBMITTALS

A. Product Data:

1. Plant, Equipment, and Tools

B. Test Reports

1. Sampling and Testing

2. Field Density Tests

1.06 QUALITY ASSURANCE

A. Sampling and testing are the responsibility of the Contractor and performed by a testing laboratory approved in accordance with Section 01 45 00 QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. Test the materials to establish compliance with the specified requirements; perform testing at the specified frequency. The Engineer may specify the time and location of the tests. Furnish copies of test results to the Engineer within 24 hours of completion of the tests.

B. Sampling

1. Take samples for laboratory testing in conformance with ASTM D75/D75M. When deemed necessary, the sampling will be observed by the Engineer

C. Tests: Perform the following tests in conformance with the applicable standards listed.

1. Sieve Analysis

a. Make sieve analysis in conformance with ASTM C117 and ASTM C136. Sieves shall conform to

ASTM E11.

2. Liquid Limit and Plasticity Index

   a. Determine liquid limit and plasticity index in accordance with ASTM D4318.

3. Moisture-Density Determinations

   a. Determine the laboratory maximum dry density and optimum moisture content in accordance with ASTM D1557.

4. Field Density Tests

   a. Measure field density in accordance with ASTM D1556 and ASTM D6938. For the method presented in ASTM D1556 use the base plate as shown in the drawing. For the method presented in ASTM D6938 check the calibration curves and adjust them, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D6938 result in a wet unit weight of soil, and ASTM D6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D6938. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals as directed. a. Submit certified copies of test results for approval not less than 30 days before material is required for the work.

   b. Submit calibration curves and related test results prior to using the device or equipment being calibrated.

   c. Submit copies of field test results within 24 hours after the tests are performed.

5. Wear Test

   a. Perform wear tests on ABC course material in conformance with ASTM C131.

D. Testing Frequency

1. Initial Tests

   a. Perform one of each of the following tests, on the proposed material prior to commencing construction, to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

   b. Sieve Analysis.

   c. Liquid limit and plasticity index.

   d. Moisture-density relationship.

   e. Wear.

   f. Soundness.

2. In Place Tests

   a. Perform each of the following tests on samples taken from the placed and compacted ABC. Samples shall be taken and tested at the rates indicated. Perform sampling and testing of recycled

concrete aggregate at twice the specified frequency until the material uniformity is established.

b. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 600, or portion thereof, of completed area.

c. Perform sieve analysis on every lift of material placed and at a frequency of one sieve analysis for every 1000 ton, or portion thereof, of material placed.

d. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.

e. Measure the total thickness of the base course at intervals, in such a manner as to ensure one measurement for each 600 square yards of base course. Measurements shall be made in 3 inch diameter test holes penetrating the base course.

E. Approval of Material

1. Select the source of the material 30 days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted course(s).

1.07 ENVIRONMENTAL REQUIREMENT

A. Perform construction when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

PART 2 – PRODUCTS

2.01 AGGREGATES

A. Provide ABC consisting of clean, sound, durable particles of crushed stone, crushed gravel, crushed recycled concrete, angular sand, or other approved material. ABC shall be free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve is known as coarse aggregate; that portion passing the No. 4 sieve is known as fine aggregate.

B. Coarse Aggregate

1. Provide coarse aggregates with angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.

a. Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below.

b. Crushed Stone: Provide crushed stone consisting of freshly mined quarry rock, meeting all the requirements specified below.

C. Aggregate Base Course

1. ABC coarse aggregate shall not show more than 50 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C131. The amount of flat and elongated particles shall not exceed 30 percent. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates shall contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces determined in accordance with ASTM D5821. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be

manufactured from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed

D. Fine Aggregate

1. Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements.

E. Aggregate Base Course

1. ABC fine aggregate shall consist of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

F. Gradation Requirements

1. Apply the specified gradation requirements to the completed base course. The aggregates shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E11. The processed binder material, when properly slaked and tested by standard laboratory methods, shall meet the following requirements of the Texas Department of Transportation Item 247, Type "A", Grade 1.

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve	
Sieve Designation	Percent Passing
Retained 1 3/4 inch sieve	0%
Retained 7/8" sieve	10% - 35%
Retained 3/8" sieve	30% - 50%
Retained No. 4	45% - 65%
Retained No. 40	70% - 85%

a. The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C127 and ASTM C128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Engineer.

b. The wet ball mill max. 40.

c. Maximum increase in materials passing the No. 40 sieve shall be 20.

d. The material shall be rejected upon visual inspection, should it contain an excessive amount of clay balls or roots. If an abundance of rocks larger than 2 inches are present in the material, they shall be removed by hand and disposed of. Limestone which fails to meet the requirements of these specifications may be rejected by the Engineer. Such rejection shall incur no cost to the Owner.

2.02 LIQUID LIMIT AND PLASTICITY INDEX

A. The liquid limit shall not exceed 35 when tested in accordance with ASTM Designation D4318.

B. The plasticity index shall be determined by testing in accordance with ASTM Designation D4318 and it shall not exceed 10 nor be less than 4.

PART 3 - 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. When the ABC is constructed in more than one layer, clean the previously constructed layer of loose and foreign matter

by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area. Provide line and grade stakes as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.02 OPERATION OF AGGREGATE SOURCES

A. Clearing, stripping, and excavating are the responsibility of the Contractor. Operate the aggregate sources to produce the quantity and quality of materials meeting the specified requirements in the specified time limit. Upon completion of the work, the aggregate sources on Government property shall be conditioned to drain readily and shall be left in a satisfactory condition. Aggregate sources on private lands shall be conditioned in agreement with local laws or authorities.

3.03 STOCKPILING MATERIAL

A. Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Engineer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

3.04 3.4 PREPARATION OF UNDERLYING COURSE

A. Prior to constructing the base course(s), the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the base course(s), the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to Section 31 00 00 EARTHWORK. Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D2487, the surface shall be stabilized prior to placement of the base course(s). Stabilization shall be accomplished by mixing ABC into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until the base course is placed.

3.05 INSTALLATION

A. EQUIPMENT: Rolling shall consist of the compaction of embankment, subgrade or flexible base by the operation of approved power rollers, as herein specified and as directed by the Engineer.

1. Steel Wheel Rollers: Steel wheel rollers shall be of the three wheel, self-propelled type, weighing not less than 10 tons (9,000 kg) and shall provide a pressure on the rear wheels of not less than 325 pounds per linear inch (6 kg linear mm) of wheel width. All wheels shall have a flat surface. Rear wheels shall have a diameter of not less than 48 inches (1.2M), and shall have a tire width of not less than 20 inches (0.5M).

2. Tamping Rollers: Tamping rollers shall consist of two metal rollers, drums or shells of not less than 40 inches (1M) in diameter; each not less than 42 inches (1M) in length and unit mounted in a rigid frame in such a manner that each roller may oscillate independently of each other. Each roller, drum or shell shall be surrounded by metal studs with tamping feet projecting not less than seven inches (18 cm) from the surface and spaced not less than six inches (15 cm) nor more than 10 inches (25 cm) measured diagonally center to center. The cross-sectional area of each tamping foot shall be not less than five square inches (160 cm2) nor more than eight square inches (400 cm2). The roller shall be equipped with cleaning teeth to provide self-cleaning. The roller shall be the type that by ballast loading, the load of each tamping foot may be varied uniformly from not less than 125 psi (.86 MPa) of cross sectional area. The Contractor may use heavier rollers with compression valves up to 500 psi (3.4 MPa) when approved by the Engineer. The load per tamping foot shall be determined by dividing the total weight of the roller by the number of tamping feet in a row parallel to or approximately parallel to the axis of the roller. The compression to be provided at any time shall be drawn by

approved power equipment with adequate traction. Power equipment used for embankment construction shall be the crawler type tractor. Two tamping rollers consisting of four cylinders, conforming to the previously prescribed requirements, drawn by approved power equipment, shall be considered as a roller unit.

3. Pneumatic Tire Roller: Tire rollers shall consist of not less than nine pneumatic tire wheels, running on axles in such a manner that the rear group of tires shall not follow in the tracks of the forward group of tires, and be mounted in a rigid frame. They shall be of the type suitable for ballast loading. The distance between the front and rear axles shall be not less than five feet (1.5M) nor more than 10 feet (3M). The front axle shall be attached to the frame in such a manner that the roller may be turned in a practical circle. The pneumatic tire roller shall have an effective rolling width of approximately 60 inches (1.5M). It shall be so designed that, by ballast loading, the load may be varied uniformly from not less than 100 pounds per inch (.69MPa) of width of tire thread. The Contractor may use heavier roller with wheel bases up to 18 feet (5.5M) when approved by the Engineer. The roller under working conditions shall provide a uniform compression under all wheels. The total combined width of effective tire threads shall be not less than 85 percent of the effective roller widths. The pneumatic tire roller shall be drawn by either an approved crawler type tractor, a pneumatic tire tractor, or a truck of adequate tractive effort; or may be self-propelled; and the roller, when drawn or propelled by either type of equipment, shall be considered a pneumatic tire roller unit.

4. Vibratory Rollers: Rollers with vibrating drums may be used for compaction of embankment or subgrades when approved by the Engineer.

B. Mixing the Materials

1. Mix the coarse and fine aggregates in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. Make adjustments in mixing procedures or in equipment, as directed, to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification

C. Placing

1. Place the mixed material on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 6 inches or less in thickness is required, place the material in a single layer. When a compacted layer in excess of 6 inches is required, place the material in layers of equal thickness. No layer shall be thicker than 6 inches or thinner than 3 inches when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable base course.

D. Grade Control

1. The finished and completed base course shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required base course thickness so that the finished base course and the subsequent surface course will meet the designated grades.

E. Edges of Base Course

1. The base course(s) shall be placed so that the completed section will be a minimum of 2 feet wider, on all sides, than the next layer that will be placed above it. Additionally, place approved fill material along the outer edges of the base course in sufficient quantities to compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 2 foot width of this material to be rolled and compacted simultaneously with rolling and compacting of each layer of base course. If this base course material is to be placed adjacent to another pavement section, then the layers for both of these sections shall be placed and compacted along this edge at the same time.

F. Compaction

1. Compact each layer of the base course, as specified, with approved compaction equipment. The moisture content shall be maintained within the limits of 2 percent below optimum to 1 percent above optimum during compaction as determined from laboratory tests as specified in this Section. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Continue compaction until each layer has a degree of compaction that is at least 100 percent of laboratory maximum density through the full depth of the layer. Make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

G. Thickness

1. Construct the compacted thickness of the base course as indicated. No individual layer shall be thicker than 6 inches nor be thinner than 3 inches in compacted thickness. The total compacted thickness of the base course(s) shall be within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated. The total thickness of the base course shall be measured at intervals in such a manner as to ensure one measurement for each 600 square yards of base course. Measurements shall be made in 3 inch diameter test holes penetrating the base course.

H. Finishing

1. The surface of the top layer of base course shall be finished after final compaction by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of base course is 1/2 inch or more below grade, then the top layer should be scarified to a depth of at least 3 inches and new material shall be blended in and compacted to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompacted or it shall be replaced as directed.

I. Smoothness

1. The surface of the top layer shall show no deviations in excess of 3/8 inch when tested with a 12 foot straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 50 foot intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.06 TRAFFIC

A. Do not allow traffic on the completed base course

3.07 MAINTENANCE

A. Maintain the base course in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any base course that is not paved over prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of base course that is damaged shall be reworked or replaced as necessary to comply with this specification.

B. The base shall be maintained throughout its entire length by the use of a standard road machine or motor grade and rollers until the asphaltic material is applied. Before preparations have started for application of the asphalt, the base course shall be allowed to partially dry until the average moisture content of the full depth of base is less than 80% of the optimum moisture of the base mixture. The drying shall not continue to the extent that the surface of the base becomes dusty, with consequent loss of binder, If, during the curing period, the surface of the base dries too rapidly, it shall be kept moist by sprinkling until such time as the asphalt shall be applied.

3.08 DISPOSAL OF UNSATISFACTORY MATERIALS

A. Any unsuitable materials that must be removed shall be disposed of as directed in waste disposal areas indicated by the Engineer. No additional payments will be made for materials that must be replace

END OF SECTION 33 40 00

SECTION 32 12 16 - ASPHALT PAVING

PART 1 - GENERAL

Drawings and general provisions of Contract, as well as all the appropriate specification sections of Division 1, apply to work of this section.

1.01 SECTION INCLUDES

A. Asphalt paving and surface preparation; wearing binder or base course.

B. Crushed limestone base material.

C. The work consists of preparing subgrade, furnishing and placing select base material, and furnishing and placing a hot mix asphaltic concrete surface on roads and parking lots.

1.02 RELATED SECTIONS

A. Section 31 22 13 - Rough Grading: Preparation of site for paving and base.

B. Section 32 17 23 - Pavement Markings.

1.03 REFERENCES

A. Texas Department of Transportation's "1993 Standard Specifications for Construction of Highways, Streets and Bridges", hereinafter referred as TxDOT's Standard Specifications.

B. MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot Mix Types - The Asphalt Institute (AI).

C. MS-3 - Asphalt Plant Manual - The Asphalt Institute (AI).

D. MS-8 - Asphalt Paving Manual - The Asphalt Institute (AI).

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with TxDOT's Standard Specifications Item 340.

B. Obtain materials from same source throughout.

C. Maintain one copy of each document on site.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Do not place asphalt when base surface temperature is less than 40 degrees F and is NOT rising, or surface is wet or frozen.

1.06 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, for submittal requirements and procedures.

B. Mix Design: Submit proposed mix design for each asphaltic concrete mixture and seal coat to be used in the work, covering the specific materials to be used in the mixes. Include test data in support of each proposed mix design.

C. Test Reports: Submit test results of sampling and testing, and inspection records within 24 hours of asphaltic concrete placement.

1.07 PROTECTION

A. Protect concrete pavements and walks, curbs and bases, and other improvements adjacent to the operations with suitable materials. The Contractor shall be responsible for any damage caused by the Contractor's employees or equipment and shall make necessary repairs. Buildings and other surfaces shall be covered with paper or other protection, where required. All damage caused by the Contractor's operations shall be repaired or replaced as required.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Hot Mix Asphaltic Concrete Surface Course shall be plant mixed, hot laid Type D (Fine Graded Surface Course) meeting the master specification requirements of TxDOT's Standard Specification's Item 340, and specific criteria for the job mix. The mix should be designed for a stability of at least 35 when compacted to between 91 and 97 percent of the maximum theoretical density as measured by ASTM D2041. See plans for heavy duty section thickness and light duty section thickness.

B. Crushed Limestone Base shall be composed of crushed limestone, meeting the requirements of TxDOT's Standard Specifications, Item 247, Grade 1 or 2, Type A.

C. The subgrade shall be MOISTURE CONDITIONED Soil subgrade should be scarified to a depth of eight inches, moisture adjusted, and recompacted to at least 95 percent of the maximum dry density as determined by ASTM D 698. Clay soils should be moisture conditioned to between -3 and +3 percent of the optimum moisture content. Care should be taken to insure that the subgrade does not dry out or become saturated prior to pavement construction. Moisture conditioning is not required in exposed limestone subgrade areas.

D. The subgrade shall be LIME STABILIZED BY scarifying to a depth of eight inches and lime stabilized. Lime placement and mixing operation should be performed in general accordance with TxDOT's Item 260. Generally, 6 to 8 percent lime should be sufficient. (See Lime Series Testing sheet from geotechnical engineer for actual percentage of lime required.) After proper curing time, the lime stabilized soils should be compacted to a dry density of at least 95 percent of the maximum dry density as determined by standard proctor (ASTM D-698) within 1 percent below to 3 percent above the optimum moisture content.

2.02 ACCESSORIES

A. Prime Coat: MC-250 Medium curing, liquid asphalt meeting TxDOT's Item 310 for Medium Curing Cutback asphalt. Contractor shall apply at the rate of 0.2 gal/square yard to seal base and at a rate of 0.5 gal/square yard to "seal" to concrete surface of gutter and other concrete surfaces.

B. Tack Coat: Shall be CSS-1 CSS-1h, RS-1 or CRS-1 Medium curing, liquid asphalt meeting TxDOT's Item 300 for Medium Curing Cutback asphalt. Contractor shall apply at the rate of 0.05 to 0.15 gal/square yard to "bond" to a previous asphaltic surface.

2.03 SEAL COAT

A. Fog seal coat or fine seal coat, as indicated, in conformance with TxDOT Standard Specifications

2.04 SOURCE QUALITY CONTROL

A. The Contractor shall perform sampling and tests of materials in accordance with the following requirements:

1. Aggregate Grading: The combined aggregate, prior to addition of asphalt binder (paving asphalt), shall conform with the "Operating Range" requirements specified in Item 340 of the TxDOT Standard Specifications for the type of aggregate specified herein. Conformance with grading requirements shall be determined by TxDOT testing requirements

2. Frequency of Tests: Minimum testing frequency shall be one test for every 500 tons, or fraction thereof, for each graded aggregate placed each day.

3. Asphalt Content: Asphalt content shall be within plus or minus 0.50 percent of the mix design content. Conformance with asphalt content requirements shall be determined by TxDOT testing requirements from samples taken from the mat behind the paving machine. Minimum testing frequency shall be one test for every 500 tons, or fraction thereof, for each asphaltic paving mix placed each day.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Required base material shall be placed on a moisture conditioned subgrade or lime stabilized subgrade. Care shall be taken to insure that the subgrade does not dry out or become saturated prior to placement of base material.

B. Verify gradients and elevations of rough grading are correct.

3.02 SUBGRADE

A. PREPARATION OF SUBGRADE:

1. Areas to receive paving shall have been cleared of all existing obstructions, and excavated, filled and subgrade prepared to a depth of 8" as required above specifications.

2. The subgrades shall have been excavated and shaped in conformity with the grading shown on the drawings and the requirements of Section 31 22 13. All unstable or other objectionable material shall have been removed from the subgrade and replaced with approved material. All holes, ruts, and depressions shall have been filled with approved materials.

3. The subgrade shall be constructed of acceptable excavated material (properly compacted), or delivered borrow material, properly worked, compacted and moisture prepared.

3.03 PREPARATION - PRIMER

A. PRIME COAT

1. Prior to the application of the prime coat, the prepared base shall be cleaned of all foreign or objectionable matter with power blowers, power brooms, or hand brooms as required.

2. Prime coat shall consist of one sprayed application of cutback asphalt, , TXDOT Item 310 applied in a range of 0.2 to 0.5 gallons per square yard over the prepared flexible base. Allow the asphalt to set uncovered only as long as necessary for the evaporation of sufficient volatiles to obtain the required tackiness for application of the surface course.

3. Application temperature 100 degrees F

4. Before spraying the finished flexible base material, cover all adjacent masonry concrete, steel, etc., to prevent staining. Cover with impermeable paper, and seal or lap the joints to insure positive protection.

5. Prime coat the portion of concrete curb and gutter (2-1/2" on gutter edge) and ends of other concrete structures which are to join H.M.A.C., with same material as prime coat.

3.04 CRUSHED LIMESTONE BASE

A. FLEXIBLE BASE (Select Base):

1. Flexible base material shall be furnished by the Contractor from sources used by City of Austin, or the Austin District of the TxDOT. Special attention shall be given to the wet ball mill test. There are several sources of flexible base which meet all the other requirements specified, except for the wet ball mill test. Material which

does not meet the specified wet ball mill test will NOT be allowed.

2. Compacted thickness for flexible base shall be as shown on the plans.

3. Flexible base material shall conform to all of the requirements of Texas SDHPT Item 247 (except paragraphs 247.4 and 247.5) for Type "A", Grade 1 or 2 (crushed stone) or better.

B. After the subbase has been compacted and shaped to grade and section, the material shall be delivered in uniform amounts. In general, the flexible base shall be laid down in conformity with Section 247.3 of the TxDOT's Standard Specifications. The crushed limestone base course should be compacted to a minimum of 95% of the maximum density as determined by the modified moisture / density relation (ASTM D 1557) at –3 to +3 percent of optimum moisture content. As an option, compaction to at least 100% percent of the TEX 113E maximum dry density will be considered.

3.05 PLACING ASPHALT PAVEMENT - SINGLE COURSE

A. H.M.A.C. shall have a compacted thickness for the section depth as shown on the plans. H.M.A.C. shall be compacted to between 91 and 97 percent of maximum theoretical density as measured by ASTM D 2041.

B. Construction Methods shall comply with the pertinent portions of paragraph 340.3 of Item 340 of the TxDOT Standard Specifications.

C. Install manhole frames in correct position and elevation.

D. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

E. Develop rolling with consecutive passes to achieve even and smooth finish, without roller marks.

F. Compacting and finishing shall be accomplished as follows:

1. The mix shall be compacted immediately after placing.

2. Initial rolling with a steel-wheeled tandem roller, steel three-wheeled roller, or a pneumatic-tired roller shall follow the paver as close as possible.

3. Intermediate rolling with a pneumatic-tired roller shall follow the paver as close as possible.

4. Final rolling shall eliminate marks from previous rolling.

5. In areas too small for the roller, a vibrating plate compactor or a hand tamper shall be used to achieve thorough compaction.

6. Compaction with Air Void Control shall meet requirements stated in TxDOT Item 340.4.H

7. Target density will be determined by taking the average density of five laboratory-prepared specimens collected at random from trucks delivering the mixture to the job site. A bulk sample must be taken at least every 300 tons or at a minimum of 1 per day.

8. Samples will be tested in accordance with TEX 207-F, TEX 222-F and TEX 227-F and test results shall be reported the same day the tests are made

3.06 SURFACE VARIATIONS:

A. The surface of the completed pavement will be checked longitudinally and transversely for smoothness with a 10 foot straightedge.

B. The surface shall not vary more than 1/8" in 10 feet.

3.07 EQUIPMENT:

A. Equipment necessary for the efficient and expeditious accomplishment of the required work shall be on hand in good condition and shall be approved before the work is started.

3.08 FIELD QUALITY CONTROL

A. The Contractor shall control the quality of the Work and shall provide adequate testing to assure compliance with these Specifications.

B. After completion of paving work, all paving shall be flooded with water, and any resulting "ponds" shall be ringed with chalk. Such hollows shall be corrected with addition of asphalt paving materials and re-rolling until all paving is completely level and free from hollows and high spots.

C. The Contractor shall perform in-place density and compaction tests of the completed pavement in accordance with TxDOT requirements to determine compliance with specified requirements. Relative compaction shall be 96 percent.

3.09 MAINTENANCE OF PAVEMENT

A. Upon completion of final rolling, traffic shall not be permitted on the finished pavement for at least six hours, and until the asphalt concrete has cooled sufficiently to withstand traffic without being deformed.

B. Finished pavement shall be maintained in finished clean condition until the Work is accepted by the Engineer.

END OF SECTION 32 12 16

SECTION 32 12 36– ASPHALT SLURRY SEAL COAT

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section specifies the requirements for placing an asphalt slurry seal coat upon an existing asphalt pavement surface for maintenance purposes as determined from the drawings and in accordance with these specifications.

1.02 APPLICABLE PUBLICATIONS

The following publications of the latest issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

A. Texas Department of Transportation 2004 Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges (TxDOT).

1. Item 300 - Asphalts, Oils and Emulsions

2. Item 302 - Aggregates for Surface Treatments

3. Item 316 - Surface Treatments

4. Item 320 – Equipment for Asphalt Concrete Pavement

B. B. American Society for Testing and Materials Standards (ASTM)

1. D8-02 – Standard Terminology Relating to Materials for Road Pavements

2. D698 - Moisture Density Relations of Soil Using 5.5 Pound Rammer and 12 Inch Drop.

C. C. Texas Department of Transportation Test Procedures

1. TEX 207-F – Determining Density of Compacted Bituminous Mixtures

2. TEX 227-F – Theoretical Maximum Specific Gravity of Bituminous Mixtures

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 32 17 23.13 Painted Pavement Markings

B. Section 32 17 23.33 Thermoplastic Pavement Markings

C. Section 32 12 16 Asphaltic Concrete Paving

D. Section 32 22 13 Site Grading

E. Section 31 11 00 Clearing and Grubbing

1.04 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.05 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Material Certificates: For each paving material, signed by manufacturers.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or if none exist, the DOT of the state in which Project is located.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.

2. Slurry Seal Coat: Comply with weather limitations of ASTM D 3910.

PART 2 - PRODUCTS

2.01 ASPHALTIC MATERIALS

A. A. Asphaltic material shall conform to the applicable requirements of Item 300, TXDOT. Asphalt Emulsion shall be AC-5.

2.02 MINERAL AGGREGATE

A. A. The aggregate and mineral filler shall be a graded sand mixture conforming to the following:

U.S. Standard Sieve Size	Total Percent Passing
No. 8	100
No. 16	65-90
No. 30	40-60
No. 50	25-42
No. 100	15-30
No. 200	10-20

2.03 SEAL COAT MIXTURE

A. The seal coat mixture shall be mixed in the following proportions based upon a 220 pound aggregate mixture. A larger mix may be made using the proper proportions.

Material	Weight (lbs)
Aggregate including mineral filler	220
Asphalt emulsion	33-66
Water, including water present in the emulsion and aggregate	22-33 (as required for emulsion and aggregate proper consistency)

2.04 EQUIPMENT

A. All equipment necessary to perform the work within the scope of this Section shall conform to requirements of TxDOT Item 316, Article 316.3.

2.05 WATER

A. Water used for mixing or curing shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

B. Water sources other than the local municipal domestic water supply must be approved by the Owner.

1. If onsite reclaimed water sources are used, tanks and apprentices must be clearly marked with the words “non-potable” water.

PART 3 - EXECUTION

3.01 3.1 GENERAL

A. Asphalt Surface Course shall be applied to existing asphaltic surface in accordance with TxDOT Item 316 Article 316.4.

B. Samples will be tested in accordance with TEX 207-F and TEX 227-F and test results shall be reported the same day the tests are made.

3.02 SURFACE PREPARATION

A. Potholes and other structural failure of the surface shall be repaired prior to placing the seal coat.

B. The surface shall be swept clean of all debris, dirt, loose gravel and other loose articles. If necessary, the surface can be washed, but the surface must be dry before the seal coat is applied.

C. For asphalt cracks that are 1/8 inch or larger, clean by brushing and treat with weed killer. Next apply GuardTop Crack filler. the crack should be filled to match the surface of the rest of the pavement. For larger cracks, GuardTop Crack filler may have to be applied several times. For large cracks that have broken asphalt and for areas that have broken asphalt, we recommend that the loose asphalt be removed and patched with new asphalt. Extreme low spots should also be filled with new asphalt. It is recommended that new asphalt should cure for a period of 30 days before sealing with GuardTop seal coat.

D. Seal coatings will not adhere to surfaces with excessive oil and grease. For a quality job, clean all oil and grease deposits with a degreasing solution using a stiff bristle broom or a power operated broom. Areas completely saturated are recommended to be removed and replaced with new asphalt, then apply GuardTop Oil Seal to all oil and grease stained surfaces. Simply brush in GuardTop Oil Seal to the surface insuring full coverage over the stain.

E. After all pavement repairs have been completed, the surface should be clean and free of all dirt, debris and existing pavement loose graveled particles. Please note that dirt and loose debris will restrict the adherence of the seal coat. To clean the surface use a power broom, power blower or flush the surface with high pressure water. This process will ensure a long lasting quality job.

F.

3.03 SLURRY SEAL COAT APPLICATION

A. Mix asphalt emulsion, water, mineral filler and aggregate in a mixer.

B. Apply mixture in an average thickness of 1/16th to 1/8th inches. The mixture should form a creamy-textured mixture which, when spread, will flow in a wave approximately two (2) feet ahead of the strike-off squeegee.

C. Allow mixture to cure for 48 hours.

D. Apply a second seal coat in the same manner as the first coat and allow the second coat to cure for 48 hours.

E. Test surface at the end of the second curing process to insure surface is dry and not tacky. Apply paint for striping and open for traffic after paint has dried.

END OF SECTION 32 12 36

SECTION 32 13 13 CONCRETE PAVING

PART 1 - GENERAL

Drawings and general provisions of Contract, as well as all the appropriate specification sections of Division 1, apply to work of this section.

1.01 SECTION INCLUDES

A. Concrete sidewalks, integral curb and gutter, concrete pavement, concrete inlets and walls

B. Moisture Conditioned Subgrade.

1.02 RELATED SECTIONS

A. Section 31 22 13 - Rough Grading: Preparation of site for paving.

B. Section 32 12 16 - Asphalt Paving: Asphalt pavement

C. Section 32 17 23 - Pavement Markings.

1.03 REFERENCES

A. Texas Department of Transportation's "1993 Standard Specifications for Construction of Highways, Streets and Bridges", hereinafter referred as TxDOT's Standard Specifications.

B. ACI 117 Standard Tolerances for Concrete Construction and Materials

C. ACI 318 Building Code Requirements for Reinforced Concrete

D. ACI 301 - Specifications for Structural Concrete for Buildings.

E. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

F. ANSI/ASTM A185 - Welded Steel Wire Fabric for Concrete Reinforcement.

G. ANSI/ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement.

H. ANSI/ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

I. ANSI/ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

J. ASTM A615 - Deformed and Plain Billet-Steel for Concrete Reinforcement.

K. ASTM C33 - Concrete Aggregates.

L. ASTM C94 - Ready Mix Concrete.

M. ASTM C150 - Portland Cement

N. ASTM C260 - Air-Entraining Admixtures for Concrete.

O. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

P. ASTM C494 - Chemical Admixtures for Concrete

Q. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc- Coated, Welded and Seamless

R. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

S. ASTM A663 Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties

T. ASTM C39 Test Method for Compressive Strength of Cylindrical Concrete Specimens.

U. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete

V. ASTM C496 Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens

W. ASTM D2628 Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements

X. FS TT-C-800 - Curing Compound, Concrete, for New and Existing Surfaces.

1.04 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Product Data: Submit the respective manufacturer's product data for manufactured products including but not limited to data on joint filler, admixtures and curing compounds.

C. Samples: Submit a sample panels, 24 by 24 inch in size illustrating exposed aggregate finish.

D. Shop Drawings:

1. Submit drawings that indicate the locations of all joints in concrete, including construction joints, expansion joints, isolation joints, and weakened-plane or contraction joints.

2. Submit drawings of reinforcing steel, tie bars, and connecting dowels. Comply with requirements specified in Section 03 20 00 - Concrete Reinforcing.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with requirements of Sections 31 00 00, 32 00 00 and 33 00 00, and the pertinent portions of TxDOT's Standard Specifications Items 360 (Concrete Pavement), 420 (Concrete Structures), 422 (Reinforced Concrete Slab, and 529 (Concrete Curb, Gutter and Combined Curb and Gutter).

B. Obtain cementitious materials from same source throughout.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

A. Form Materials: As specified in Section 330000 Wood or steel form material, profiled to suit conditions.

B. Joint Filler: Boards where called for shall be obtained from redwood timber, being sound heartwood free from sapwood, knots, checks and splits.

C. Provide metal forms, weighing not less than 18 pounds per linear foot for pavement 8 inches thick, not less than 20 pounds per linear foot for pavement 9 inches thick, and not less than 22 pounds per linear foot for pavement 10 inches

thick, and in no case less than 7/32 inch thick.

D. Provide side forms having a depth equal to the prescribed edge thickness of the pavement, without horizontal joints.

E. Provide forms having a base not less than 8 inches wide and a flanged tread or top surface not less than 2 inches wide. For multiple lanes, provide base width at least equal to height.

F. Provide forms not less than 10 feet long except where shorter forms are necessary for curves. Use metal keyway forms for the full length of roadway form to which attached. Provide wood bulkheads for the full width of pavement lane equipped with keyway form.

G. Provide holes for bars and dowel assemblies where required.

H. Provide at least three stake pockets to accommodate a 1 inch diameter stake in each section of form 10 feet or more in length, and at least two such pockets in each section of form less than 10 feet long.

I. Provide each section of form with a positive locking device that will secure it tightly to the adjoining section.

J. Provide forms free from warp and of sufficient strength to resist, without visible springing or settlement, all loads applied in the paving process.

2.02 CONCRETE MATERIALS

A. Cement: ASTM C150 Normal - Type I or Air Entraining - Type IA type, grey color.

B. Fine and Coarse Mix Aggregates: ASTM C33.

C. Water: Potable, not detrimental to concrete.

D. Air Entrainment: ASTM C260.

E. Chemical Admixture: ASTM C494, [Type A - Water Reducing] [Type B - Retarding] [Type C - Accelerating] [Type D - Water Reducing and Retarding] [Type E - Water Reducing and Accelerating] [Type F - Water Reducing, High Range Admixtures] [Type G - Water Reducing, High Range, and Retarding Admixtures].

2.03 ACCESSORIES

A. Liquid Asphalt: AASHTO M81, cut-back asphalt, rapid-curing type.

B. Subgrade Paper: Kraft laminated building paper with bituminous binder, reinforced, meeting requirements of FS UU-B-790.

C. Benches and Chairs: ACI 318.

D. Tie Bars: ASTM A615, Grade 60, of type and size indicated.

E. Dowels: Plain round bars meeting requirements of ASTM A615, Grade 60, or ASTM A663, Grade 80, epoxy-coated bars, furnished with approved snug-fitting ASTM A53 galvanized pipe sleeve. Provide sleeve with one end closed. H. Expansion-Joint Filler: ASTM D2628, preformed elastomeric joint seal.

F. Joint Sealing Material shall be TxDOT's Class 5, 1 part low modulus silicone formulation, which does not require a primer to bond to concrete and especially designed to cure at ambient temperatures by reacting with moisture in the air. Install full depth into saw cuts without a backer rod and flush with concrete surface. A backer rod, if allowed, shall not bond or react with the sealant. The manufacturer of the joint sealant shall furnish certification that the product meet or exceeds the following specifications after 7 days curing at 77°F and 40% RH:

1. Full Adhesion 14 to 21 days
2. Elongation 1200 percent
3. Durometer Hardness, Shore A-80 or D-50 (ASTM D2240)
4. Joint Movement Capability, +100% to -50%
5. Tensile Strength, 100 psi at maximum elongation
6. Peel Strength 25 psi

G. Concrete Curing Compound: ASTM C309, Type 1.

2.04 CONCRETE MIX

A. Mix concrete in accordance with ACI 304. Deliver concrete in accordance with ASTM C94.

B. Provide concrete for pavement to the following criteria: Design mixture shall exhibit a flexural strength (3 point loading) of at least 500 psi at 28 days. The flexural strength (M^r) may be approximated by the formula from ACI 330R $M^r=2.3(f^c{}_{2/3})$ where f^c is the compressive strength of the concrete. The actual relationship between flexural and compressive strength for the proposed mix shall be derived and evaluated in the laboratory. As an option, a 28 day compressive strength requirement of 4000 psi may be utilized.

C. Use accelerating admixtures in cold weather only when approved by Architect/Engineer. Use of admixtures will not relax cold weather placement requirements.

D. Use calcium chloride only when approved by Architect/Engineer.

E. Use set retarding admixtures during hot weather only when approved by Architect/Engineer.

F. Provide concrete for sidewalks, curb and gutter and other non-structural concrete to the following criteria: Design mixture shall be 5 sack minimum with a 28 day compressive strength requirement of 3000 psi minimum.

G. Provide concrete for retaining walls, steps, and other site structural concrete to the following criteria: Design mixture shall be 6 sack minimum with a 28 day compressive strength requirement of 3600 psi minimum. Fly ash of approved quality (approved for the purpose by the Texas Department of Transportation and/or the City of San Antonio) may be substituted for 1 sack of regular cement resulting in a mix that incorporates 5 sacks of portland cement and 1 sack of approved fly ash.

H. Provide concrete for paving to the following criteria: Design mixture shall be 6 sack minimum with a 28 day compressive strength requirement of 4000 psi minimum. Fly ash of approved quality (approved for the purpose by the Texas Department of Transportation and/or the City of San Antonio) may be substituted for 1 sack of regular cement resulting in a mix that incorporates 5 sacks of portland cement and 1 sack of approved fly ash.

2.05 SOURCE QUALITY CONTROL

A. Provide mix design for review and approval of Architect/Engineer.

B. Submit proposed mix design of each class of concrete to appointed firm for review prior to commencement of work.

C. Tests on cement and aggregates will be performed to ensure conformance with specified requirements.

D. Test samples in accordance with ACI 301.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Portland Cement Concrete Pavement not a part of this contract.

B. Verify gradients and elevations of rough grading are correct.

C. Prepare all areas to receive concrete in accordance with the TxDOT's Standard Specifications Items 360 (Concrete Pavement), 420 (Concrete Structures), 422 (Reinforced Concrete Slab, and 529 (Concrete Curb, Gutter and Combined Curb and Gutter).

3.02 PREPARATION OF SUBGRADE

A. Areas to receive paving shall have been cleared of all existing obstructions, and excavated, filled and subgrade prepared to a depth of 6" as required above specifications.

B. The subgrades shall have been excavated and shaped in conformity with the grading shown on the drawings and the requirements of Section 31 22 13. All unstable or other objectionable material shall have been removed from the subgrade and replaced with approved material. All holes, ruts, and depressions shall have been filled with approved materials.

C. The subbase shall be constructed of acceptable excavated material (properly compacted), or delivered borrow material, properly worked, compacted and moisture prepared.

D. Immediately prior to placing forms, condition and trim subgrade, subbase, or base to exact shape, grade, and cross section required by the Contract Drawings. Condition and shape to indicated width between side forms plus not less than one extra foot on each side.

E. Notify Architect/Engineer minimum 24 hours prior to commencement of concreting operations. Use of a subgrade machine of approved type is permitted, in which case place forms in advance of exact conditioning and trimming, to permit use of the machine.

F. Where the crown is to be warped or sloped to conform to contour of intersecting streets, storm water inlets, and other intersecting contoured surfaces, shape subgrade to required depth and cross section by means of hand tools and other equipment as approved by the Engineer. In addition:

1. Drive grade stakes to proper elevation in the subgrade at 6-foot intervals in both directions.

2. Compact subgrade by rolling at least 1 foot wider on each side than the concrete.

3. Finish concrete in such locations by means of floats, shovels, spades, or other approved hand tools, operated so as to consolidate the concrete without segregation.

G. Deposit any excess material obtained from such preparations upon adjacent shoulders or as required.

3.03 PREPARATION

A. Moisten subgrade to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.

3.04 FORMING

A. Place and secure forms to correct location, dimension, and profile.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

D. Obtain written approval from the Engineer of the subgrade, subbase, or base prior to placing forms and impervious compacted subgrade.

E. Place subgrade paper where indicated.

F. Do not use built-up forms. Remove forms with battered top surfaces, distorted faces or bases, and forms that are deformed or broken in any way; and, if straightened and repaired, do not reuse until they have been inspected and approved in writing by the Engineer.

G. Do not use forms showing a variation of more than 1/8 inch in a 10-foot length from the plane of the top or face when tested with a straightedge.

H. Join forms neatly and tightly and stake securely with stakes in every pocket. Drive up fully all locking devices at form joints so as to produce a smooth fitting, rigid joint.

I. Maintain proper grade and alignment under all working conditions. Maintain base of forms directly in contact with the finished subgrade, base, or subbase.

J. Building of pedestals of earth or other materials upon which to rest forms in order to bring them to the required grades will not be permitted.

K. Clean and coat forms with form release compound before concrete is placed against them, each time they are used.

L. Do not remove forms from freshly placed concrete until the concrete has set for 12 hours

3.05 REINFORCEMENT FOR CONCRETE PAVEMENT

A. Place #3 rebars at 18" on center both ways and/or as shown on the drawings.

B. Provide 0.25 inch deep sawcuts at 15 feet intervals. Fill with urethane material .

C. When reinforcement is indicated, provide deformed bars, welded wire fabric, or prefabricated welded or clipped deformed bar mats, as indicated on the Contract Drawings, and of size and quantity indicated.

D. Place reinforcement so that the extreme longitudinal member will be located not more than 3 inches from the sides of the slab section, and extend the end of all longitudinal members to within 2 inches of the ends of slab sections.

E. Lap adjacent sheets of welded wire fabric and welded or clipped mats not less than 12 inches when the lap is made at right angles to the centerline of the pavement and where wire fabric sheets are permitted to be lapped parallel to the centerline.

F. Wrap the wire fabric or bar mats together with wire at all laps, at intervals not exceeding 24 inches.

G. Reinforce multiple lane construction with bar mats or sheets of welded wire fabric of same weight and size as though the paving were constructed in single lane widths. Install mats or sheets so as to leave an unreinforced longitudinal gap 6 inches wide, parallel to and centered on the lane lines.

H. Place tied bars or prefabricated bar-mat reinforcement securely supported on approved chairs as specified in Section 03 20 00, Concrete Reinforcing, and ACI 318. Install reinforcement in place on supports on the subgrade for a distance ahead of the paver equal to at least 500 feet or a two-hour run of the paver, whichever is greatest, before any paving is begun. Stop paving and install a bulkheaded construction joint whenever the paver comes to within 100 feet of the end of such steel placement. Secure reinforcement against displacement during concrete placement.

I. Tie Bars and Dowels:

1. Uniformly place all tie bars and dowel assemblies at the indicated depth below finished surface on 4-foot centers or other dimensions where indicated otherwise on the Contract Drawings.

2. In all of the above methods of reinforcement placement, install dowel bar assemblies and secure in place in metal chairs on the subgrade, ahead of the placement of the slab reinforcement and concrete.

3. Support tie bars for weakened-plane joints on metal chairs and securely fasten prior to placing concrete, or place on top of the freshly poured concrete and vibrate to position at proper depth. Install tie bars in such manner that upon initial set of the concrete they will be at proper alignment, depth and spacing, and at right angles to the designated line of cut.

4. Place tie bars for construction joints on metal chairs, or machine place, in such a manner that upon the initial set of the concrete, they will be at proper alignment, depth, and spacing, and at right angles to the formed edge of the joint.

3.06 PLACING CONCRETE

A. Place concrete as specified in Section 33 00 00 and the pertinent requirements of TxDOT's Standard Specifications Items 360 (Concrete Pavement), 420 (Concrete Structures), 422 (Reinforced Concrete Slab, and 529 (Concrete Curb, Gutter and Combined Curb and Gutter)..

B. Ensure reinforcement, inserts, embedded parts, formed joints and manhole frames are not disturbed during concrete placement.

C. Place concrete continuously between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.

D. Contractor shall submit for Architect/Engineer's approval, a sketch showing the placement of all joints for the service yard. Place all other concrete to a pattern as indicated on the drawings.

E. Notify the Engineer at least 24 hours in advance of placing concrete.

F. In the event completion of concrete placement during darkness should become necessary, provide a lighting system adequate to illuminate all concrete-placement operations.

G. An interval of more than 45 minutes between placing of two consecutive concrete batches will be cause for stopping paving operations. Should this occur, place a bulkhead with construction joint keyway.

H. Place concrete while fresh. Retempering of concrete will not be not permitted.

I. Do not chute concrete directly on to subgrade or subbase from any type of hauling unit without written permission from the Engineer.

J. Place concrete pavement in full traffic lane widths, separated by construction joints; or if approved, the concrete pavement may be placed monolithically, two or more traffic lanes wide without a construction joint, but with a longitudinal weakened-plane joint at each traffic lane line.

K. Deposit concrete in successive batches on the subgrade or subbase to full width of traffic lane and strike off with an approved screed-type finishing machine.

L. When constructing adjacent traffic lanes, the wheels of the finishing machine that rest on previously completed concrete shall be flat, without flanges, and the inside edge of the tread of the wheels shall not operate so close to edge of slab as to cause spalling or damage. The tread of the wheels shall not be less than 3-inches in width. The wheels on the opposite side, that operate on the steel side forms, shall have flanges on both sides.

M. Use a mechanical spreader of an approved type, designed to move the volume of freshly deposited concrete transversely.

N. Use concrete already placed in adjacent traffic lane, curb, or gutter as the form for new concrete placed adjacent thereto, but not until the concrete placed in the first lane has attained a split tensile strength of at least 300 pounds per square inch, as determined by ASTM C496.

O. Consolidate concrete by means of suitable vibrating screed, internal vibrator, or other approved vibratory equipment such that the concrete is effectively consolidated without segregation. Maintain amplitude of vibration such that the vibrations are perceptible on the surface of the concrete at least one foot from the vibrating equipment. Provide a device for measuring and indicating the actual frequency of vibrations.

P. Perform screeding and tamping by making one complete pass over the entire area of the pavement. Adjust the tamper to produce the proper tamping action and adjust screeds to an elevation slightly above finished grade, so that when properly consolidated and finished, the completed surface of the pavement will be at the required grade, true to cross section indicated, and free from laitance and porous areas.

Q. Concrete required to be placed in widths less than a normal traffic lane may be compacted and shaped by a powered mechanical compacting and shaping machine supplemented by hand methods as necessary. Deposit concrete as nearly as possible in its final position. Do not use vibrators for extensive shifting of masses of fresh concrete.

3.07 JOINTS

A. Place expansion joints at 40 feet intervals for concrete curb and gutter and as called for on the drawings for concrete sidewalk and slabs. Align curb, gutter, and sidewalk joints.

B. Place joint filler between paving components and building or other appurtenances. Recess top of filler 1/4 inch sealant placement.

C. Provide sawn joints at 5 feet intervals at all sidewalks.

D. Provide keyed joints as indicated at a minimum of 75 feet.

E. Provide sawn joints at a maximum of 15 feet intervals on concrete paving.

F. General:

1. Joints in pavement are designated as longitudinal and transverse construction joints, transverse expansion joints, and longitudinal and transverse weakened-plane joints

2. Construct the faces of all joints normal to the finished surface of the road.

3. Construct transverse joints normal to the centerline of the road and extending full width of pavement. Construct similar types of transverse joints in line with each other across the full width of the pavement.
4. Construct longitudinal joints coincident with or parallel to the pavement centerline.

5. Install load transfer devices parallel to finished surface of the road.

6. Maintain finished surface of concrete in the same plane on both sides of a joint.

G. Construction Joints:

1. Construction joints shall be made when placing fresh concrete against hardened concrete at planned locations and elsewhere when concreting is interrupted for longer than 45 minutes.

2. Connect concrete on both sides of longitudinal construction joints with tie bars as indicated.

3. Do not place transverse construction joints within 10 feet of any other transverse joint. Should it become necessary to stop concreting for a period of time sufficient to require the installation of a bulkhead and construction joint within 10 feet of an existing transverse joint, remove and waste the concrete that has been placed beyond the existing joint.

H. Transverse Expansion Joints:

1. Form transverse expansion joints at indicated locations by means of preformed expansion joint filler. Support the joint strips in position by means of metal holders and end supports. Hold the supports firmly in position during concreting, and maintain them in place after completion of pavement.

2. Use metal holders fabricated of minimum 16-gage sheet steel in the form of a deep channel extending not less than 4 inches downward on both sides of the joint strip, slotted and cut away as necessary to allow the concrete to make close contact with the joint strip at close intervals. Spread ends of holders to admit the end supports.

3. During placement and consolidation of concrete, secure joint holder and end supports so as to prevent movement of the joint strip and to keep the top edge of the joint strip approximately 1/2 inch below the surface of finished pavement. After concrete has been placed and consolidated, the metal holder may be removed and a suitable metal channel substituted therefore; fit the channel snugly over the top edge of the joint strip and maintain it there until the joint is edged.

4. After side forms are removed, remove concrete that has flowed around the ends of the joint filler.

I. Weakened-Plane Joints:

1. Construct weakened-plane joints with a power concrete or masonry saw to a depth of not less than 2 inches and a width of 1/4 inch, plus or minus 1/16 inch. Produce clean cuts with sharp edges and no dislocation of coarse aggregate.

2. Saw weakened-plane joints not less than twelve hours nor more than twenty-four hours after placing concrete, unless otherwise approved by the Engineer. Conduct night operations if necessary to meet these time limits. Maintain a stand-by power concrete saw on the site at all times when paving operations are under way.

3. Do not saw where volunteer transverse cracks exist. If a volunteer transverse crack exists within 5 feet of a planned, sawed joint, omit the sawed joint, but do not omit more than three consecutive planned, sawed joints.

4. 4. Restore curing compound disturbed by sawing operations. Conduct sawing operations in such a manner that the surface and edges of pavement will be unprotected for not more than 20 minutes.

5. At the Contractor's option, longitudinal weakened-plane joints at traffic lane lines in multilane monolithic concrete pavement may be formed by placing a continuous strip of plastic or other approved material that will not react adversely with the concrete. Use joint insert material of such width and character that, when placed vertically in the concrete, it will not bond with the concrete and will form an effective weakened-plane joint not less than 2 inches deep.

6. Insert the joint material with a mechanical device that places the material in a continuous strip, except where intervening structures break the continuity of paving. Splices in joint material will be permitted if splices are effective in maintaining the continuity of the joint material as placed.

7. Maintain top of joint material not more than 1/8 inch below finished surface of concrete. Do not deform joint material from a vertical position. Maintain alignment of finished joint parallel with center line of pavement, and free of local irregularities that exceed 1/2 inch, measured by a 12 foot straightedge, except for normal curvature of center line alignment.

8. Use a mechanical installation device to vibrate the concrete during placement of the strip, to cause the concrete to flow evenly about the joint material.

9. On completion of joint sawing, or on removal of the optional joint insert material, clean the joint and remove moisture by blowing with compressed air if necessary. Fill the joint with joint sealing compound in accordance with the manufacturer's instructions.

3.08 FINISHING

A. Concrete Paving: rough broom finish parallel to curbs.

B. Sidewalk Paving: radius to 1/4 inch radius, and trowel joint edges. Light broom finish or Rock Salt Finish- Water softener salt crystals 1/8" to 3/8" in size broadcast onto the fresh concrete. With a Roller or Float press the salt crystals into the concrete. Wash surface after 24 hours until salt is dissolved and leaving small holes.

C. Curbs and Gutters: Light broom finish.

D. Inclined Vehicular Ramps: Broom perpendicular to slope and provide scored joints as called for on the drawings or approved by Architect/Engineer.

E. Inclined Handicapped Ramps: Accessibility rules require a different color tactile surface. Contractor shall use special "brick" accepted for the purpose by the City of San Antonio or provide colored (red) portland cement concrete with scoring at 1" on center.

F. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

G. Following placing of concrete, and after it has been screeded with a transverse finishing machine, screed longitudinally with a power-operated longitudinal finishing machine of an approved type. Work longitudinal screed cross-wise so as to level any irregularities in the surface.

H. Following longitudinal screed, use an approved scraping strike off for removing any accumulation of excess mortar, laitance, or inert material from the surface.

I. For the final finish, drag surface with a single full width strip of burlap to produce a uniform gritty texture on the surface. Keep burlap wet and periodically wash out to remove accumulations of mortar.

J. After burlap dragging has been completed and concrete has taken its initial set, use an edging tool with 1/4 inch radius along each edge of the surface to prevent chipping of the edges in the removal of forms. Tool in same manner the longitudinal edge of any concrete surface adjoining previously placed pavement, to avoid subsequent spalling. Edge all joints at the same time, working from suitable bridges. Take particular care to keep surface of concrete in the same plane on both sides of each joint. Kneeling planks will not be permitted on the concrete surface.

K. Where special circumstances require, hand float finishing may be substituted for a finishing machine, providing the following requirements are met:

1. Use float of approved design and construction to provide a true floated surface.

2. Operate each float from the side of the pavement and parallel to the centerline of the pavement.

3. Use edge of float to cut down high areas. Float removed material into depressions until a true surface is obtained.

4. On each successive passage of the float, slightly lap the previous path; and, upon completion of each passage, bring the float back and smooth the overlap between the two passages.

5. Operate floats as far back of tamping machine as the concrete remains workable, with sufficient passes to remove perceptible irregularities.

6. Maintain at least one spare float in good condition and available on the worksite at all times.

3.09 CURING AND PROTECTION

A. Comply with the applicable requirements of Section 03 35 00 - Concrete Finishing, for curing concrete with liquid membrane-forming curing compound. Do not permit traffic on new concrete pavement until the concrete has attained its 28-day compressive strength as determined by strength tests in accordance with ASTM C39.

3.10 INSTALLATION OF JOINT SEALS

A. Install joint fillers and sealing compounds where indicated in accordance with applicable requirements of Section 03 15 00 - Concrete Accessories.

3.11 SCHEDULES

A. Concrete Sidewalks: 3,000 psi 28 day concrete, thickness shown on the drawings. Use #3 rebars at 18" on centers both ways. Welded wire fabric is NOT allowed.

B. Curb and Gutter 3000 psi 28 day concrete with 2 continuous # 4 rebars as called for on the drawings.

C. Concrete Paving: 4,000 psi 28 day concrete, Thickness shown on the drawings. Use #3 rebars at 18" on center both ways.

3.12 FIELD QUALITY CONTROL

A. Strength Tests: The Contractor shall perform strength tests of concrete as specified in Section 03 05 15 - Portland Cement Concrete.

B. Thickness: After pavement is placed and cured, the Contractor shall take core samples at locations designated by the Engineer, for determination of actual thickness. A minimum of one core sample shall be obtained from each 100 feet of roadway for each lane.

C. Testing firm will take cylinders and flexural beams and perform slump and air entrainment tests in accordance with ACI 301.

D. Three concrete test cylinders will be taken for every 75 or less cu yds of each class of concrete placed each day.

E. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.

F. One slump test will be taken for each set of test cylinders taken.

G. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

END OF SECTION 32 13 13

SECTION 32 13 73 CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. Cold-applied joint sealants.
2. Hot-applied joint sealants.
3. Cold-applied, fuel-resistant joint sealants.
4. Hot-applied, fuel-resistant joint sealants.
5. Joint-sealant backer materials.
6. Primers.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing non-traffic and traffic joints in locations not specified in this Section.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Paving-Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer. Submit evidence of at least 5 projects with similar scope of work and requirements.

B. Product Certificates: For each type of joint sealant and accessory.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.06 FIELD CONDITIONS

A. Do NOT proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).

2. When joint substrates are wet.

3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

2.02 COLD-APPLIED JOINT SEALANTS

A. Single Component, Pourable, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

1. Products: Subject to compliance with requirements, provide the following:

a. Sikaflex 1A

2.03 COLD-APPLIED, FUEL-RESISTANT JOINT SEALANTS

A. To be used only in vehicular areas.

B. Fuel-Resistant, Single-Component, Pourable, Modified-Urethane, Elastomeric Joint Sealant: ASTM C 920, Type S, Grade P, Class 25, for Use T.

1. Products: Subject to compliance with requirements, provide the following:

a. BASF Building Systems; Sonomeric 1.

2.04 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Joint Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

D. Backer Strips for Cold- and Hot-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.05 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.

2. Do not stretch, twist, puncture, or tear joint-sealant backings.

3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.

2. Completely fill recesses in each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.

2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.04 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

3.05 PAVING-JOINT-SEALANT SCHEDULE

A. Urethane Joint Sealant: Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT. In manufacturer’s full range of colors to match surrounding materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Pecora Corporation; http://www.pecora.com/; Dynatrol I-XL.

b. Polymeric Systems, Inc.; http://www.polymericsystems.com/; Flexiprene 1000.

c. Schnee-Morehead, Inc.; http://www.schneemorehead.com/; Permathane SM7100.

d. Sika Corporation, Construction Products Division; http://www.sikausa.com/; Sikaflex - 1a.

e. Tremco Incorporated; http://www.tremcosealants.com/; Dymonic

B. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type S, Grade NS, Class 25, for Use T. In manufacturer’s full range of colors to match surrounding materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation, Construction Products Division; http://www.sikausa.com/; Sikaflex - 1a.

b. Tremco Incorporated; http://www.tremcosealants.com/; Vulkem 116.

3.06 Joint Sealant Backing:

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

END OF SECTION 32 13 73

SECTION 32 16 21 CONCRETE CURBS, GUTTERS, AND WALKS

PART 1- GENERAL

1.01 SECTION INCLUDES

A. Materials and accessories.

B. Preparation of sub grade.

C. Types of construction.

D. Joints.

E. Form removal.

F. Finishing.

G. Curing and protection.

H. Field quality control.

1.02 RELATED SECTIONS

A. Preparation of sub grade to proper grade for concrete, including compaction, is specified in Section 31 00 00 - Earthwork.

B. Portland cement concrete, concrete reinforcement, and various materials, services, and incidentals pertaining thereto shall conform with Section 03 15 00 - Concrete Accessories, Section 03 20 00 - Concrete Reinforcing, Section 03 30 00 - Cast-In-Place Concrete, Section 03 05 15 - Portland Cement Concrete, and Section 03 35 00 - Concrete Finishing.

1.03 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 117 Standard Specification for Tolerances for Concrete Construction Materials

2. ACI 301 Standard Specifications for Structural Concrete

3. ACI 318 Building Code Requirements for Reinforced Concrete

B. American Society for Testing and Materials (ASTM):

1. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

2. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

3. ASTM A663 Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties

4. ASTM C260 Specification for Air-Entraining Admixtures for Concrete

5. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete

6. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete

1.04 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Product Data: Submit the respective manufacturer's product data for manufactured products.

C. Shop Drawings:

1. Submit drawings that indicate the section profile of curb and gutter, and the locations of joints in concrete, including construction joints, expansion joints, isolation joints, and contraction joints.

2. Submit drawings of extruded curbs and gutters, if proposed, and any modification of the indicated section profile required by the extrusion process.

3. Submit drawings of reinforcing steel, tie bars, and connecting dowels. Comply with requirements specified in Section 03 20 00 - Concrete Reinforcing.

1.05 QUALITY ASSURANCE

A. Tolerances:

1. Construct concrete surfaces within 1/4 inch of the indicated elevation, and deviating not more than 1/8 inch from a 10-foot straightedge placed anywhere on the surface.

2. Slab tolerances shall be “straightedge tolerance” as specified in ACI 117.

B. Finishes: Slab finishes shall be as specified herein in accordance with the requirements of ACI 301.

C. Site Mock-Ups: Provide site mock-up, in accordance with Section 01 43 38 - Field Samples and Mockups, at least 3 feet by 4 feet in size, of slab finishes for walks, for the Engineer's review and approval. Site mock-ups require approval of the Engineer in writing before this work may proceed.

PART 2 - PRODUCTS

2.01 MATERIALS AND ACCESSORIES

A. Concrete Reinforcement: Refer to Section 03 20 00 - Concrete Reinforcing, for requirements.

B. Portland Cement Concrete: Refer to Section 03 05 15 - Portland Cement Concrete, for requirements. Provide Class of Concrete indicated on the Contract Drawings.

C. Benches and Chairs: ACI 318.

D. Tie Bars: ASTM A615, Grade 60, of type and size indicated.

E. Dowels: Plain round bars meeting requirements of ASTM A615, Grade 60, or ASTM A663, Grade 80, epoxy-coated bars, furnished with approved snug-fitting ASTM A53 galvanized pipe sleeve. Provide sleeve with one end closed.

F. Weep Holes: ASTM A53 galvanized pipe of size indicated.

G. Expansion-Joint Filler and Joint Sealing Compound: Refer to Section 03 15 00 -Concrete Accessories, for requirements.

H. Surfacing Material for Nonslip Finish: Refer to Section 03 35 00 - Concrete Finishing, for requirements.

I. Concrete Curing Compound: ASTM C309, Type 1-D, Class A.

J. Epoxy Adhesive: ASTM C881, Type V for load-bearing concrete, Grade and Class as determined by project conditions and requirements.

PART 3- EXECUTION

3.01 PREPARATION OF SUBGRADE

A. Excavate for and prepare the sub grade as specified in Section 31 00 00 - Earthwork, true to the indicated grade and cross section.

B. Test completed sub grade for correct grade and cross section by means of template supported on side forms.

C. Dampen sub grade and forms just before placing concrete.

3.02 TYPES OF CONSTRUCTION

A. Provide cast-in-place concrete construction, plain or reinforced as indicated. Curbs and gutters shall be formed accurately to indicated section profile with template screed.

B. Extruded curbs and gutter, placed by an extrusion machine, may be provided where site conditions are suitable and the extrusion process is appropriate for the purpose.

3.03 JOINTS

A. Expansion Joints:

1. Construct 3/8-inch to 1/2-inch thick expansion joints in the following locations:

a. In curb and combination curb and gutter at the locations of expansion joints in the concrete roadway.

b. In curb or combination curb and gutter, at points where curved and tangent sections join.

c. Between curb or combination curb and gutter, and any drain inlet, or similar structure occurring within the limits of the curb or combination curb and gutter.

d. At corners in sidewalks, following the projections of the building lines from the corner of the building to the curb.

e. Between sidewalks and any permanent structure.

f. Between sidewalk and curb.

g. Through sidewalks at intervals not greater than 15 feet.

h. In sidewalks, encircling fixtures more than 12 inches in diameter.

2. Construct expansion joints as specified in Section 32 13 13 - Concrete Paving, except that load transfer devices will not be required unless indicated. Shape preformed filler to cross section of curbs and combination curb and gutter.

B. Contraction Joints: In sidewalks, provide contraction joints as indicated in uniform intervals not greater than 6 feet, with the edges rounded to a 1/4-inch to 3/8-inch radius.

C. Tooling: Finish joints with an edging tool having 1/4-inch to 3/8-inch radius, leaving joints free of mortar and concrete. In

preformed type joints, leave joint filler material exposed for full length of joint with clean and true edges.

D. Joint Sealing:

1. Seal to within 1/8 inch of pavement surface joints in curbs and gutters, including gutter surfaces of combination curb and gutter sections; all joints between curbs and vehicular pavement; all joints between gutters and vehicular pavement; and all other expansion joints. Do not seal other joints unless so indicated.

2. Do not seal joints until concrete curing is complete. Prior to installation of the joint sealing compound, clean the joints of dirt and other foreign material. Joints may be cleaned with compressed air jets provided that the air in such jets is free of oil or water. Do not fill joints when there is any free water in or adjacent to the joints. Joint walls and all surfaces to which the sealing material is to adhere shall be surface dry for at least three hours prior to sealing.

3. Apply with approved pressurized equipment. Perform sealing of joints to make them impervious to water and to prevent the sealing compound from spreading over the surface of the pavement.

3.04 FORM REMOVAL

A. Remove front curb forms not less than two nor more than six hours after placing concrete, but in no case while the concrete is still plastic enough to slump.

B. Remove other forms not less than twelve hours after finishing is completed.

3.05 FINISHING

A. Curb and Combination Curb and Gutter:

1. Trowel the face of curb smooth to a depth of not less than 2 inches below the flow line, or to the flow line of integral curb and gutter, and finish with a steel trowel, all immediately after removal of front curb forms.

2. Finish all curb edges with a radius of 1/2-inch.

3. Provide a final fine brush finish to both top and face of curb with brush strokes parallel to the line of the curb, so that both top and front face present the same uniform appearance.

4. Keep the curb face wet during above finishing operations.

5. Allow no coarse aggregate to show on the finished curb surface.

B. Sidewalk, Island Paving, and Ramps

1. After the concrete has been placed, consolidated, struck off, leveled, grooved and edged as specified herein and in Section 03 30 00 - Cast-In-Place Concrete, and in Section 03 35 00 - Concrete Finishing, do not work the concrete further until ready for floating.

2. Provide "floated finish" or light "broom finish" as indicated in accordance with the requirements of ACI 301.

3. For pedestrian and wheelchair ramps, and all other surfaces where the Contract Drawings require a non-slip finish, provide a "nonslip finish" in combination with a "floated finish" or "broom finish" in accordance with the requirements of ACI 301.

4. Broom finish shall be applied perpendicular to the direction of traffic flow.

5. As shown on the drawings the curb ramp shall have a recess to accept tactile unit pavers as called out in

Section 32 14 13 TACTILE UNIT PAVERS. The tactile unit pavers shall be the full width and Length of the curb ramp to satisfy Federal ADA requirements.

C. Joints and Edges: As soon as the condition of the work permits, perform joint work, edging, and marking. Finish all edges with a radius of 1/4 inch to 3/8 inch.

3.06 CURING AND PROTECTION

A. Comply with the applicable requirements of Section 03 35 00 - Concrete Finishing, for curing concrete with liquid membrane-forming curing compound. Do not permit traffic on new concrete pavement until the concrete has cured a minimum period of ten days.

B. Provide damp curing only, in accordance with Section 03 35 00 - Concrete Finishing, for concrete slab surfaces indicated to be treated with concrete hardener and dust proofer.

3.07 FIELD QUALITY CONTROL

The Contractor shall perform inspections and tests as specified by the geotechnical engineer. The Contractor shall provide such samples and services to facilitate testing as specified by the geotechnical engineer.

END OF SECTION 32 16 21

SECTION 32 17 13 PARKING BUMPERS

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Parking bumpers.

B. Adhesive.

C. Steel bars for installation.

1.02 REFERENCES

A. American Concrete Institute (ACI):

1. ACI 117 Standard Specification for Tolerances for Concrete Construction Materials
2. ACI 301 Standard Specifications for Structural Concrete
3. ACI 318 Building Code Requirements for Reinforced Concrete

B. American Society for Testing and Materials (ASTM):

1. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
2. ASTM A615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
3. ASTM A663 Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties
4. ASTM C260 Specification for Air-Entraining Admixtures for Concrete
5. ASTM C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
6. ASTM C881 Specification for Epoxy-Resin-Base Bonding Systems for Concrete

1.03 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 – Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Shop Drawings: Submit Shop Drawings of bumpers, including plan layout and installation details, for approval.

C. Product Data: Submit manufacturers' product data of precast bumpers and epoxy adhesive for approval.

1.04 QUALITY ASSURANCE

A. Precast parking bumpers shall be manufactured for the intended purpose by a company or firm specializing in the manufacture of precast concrete parking appurtenances.

PART 2 – PRODUCTS

2.01 MATERIALS

A. A. Parking Bumpers:

1. Provide precast concrete parking bumpers of half octagonal configuration and dimensions indicated. Unless indicated otherwise, provide bumpers of 36-inch length.

2. 2. Bumpers shall be manufactured of Class 4000 reinforced concrete, as specified in Section 03 05 15 - Portland Cement Concrete, to withstand constant use and rough service. Each bumper shall be reinforced with two No. 4 deformed steel reinforcing bars, minimum.

3. 3. Each bumper to be installed on at-grade asphalt pavement shall be manufactured with two holes to accommodate the installation rebar. Holes shall be positioned 6 inches in from each end.

4. 4. Bumpers to be installed on concrete slabs of parking structures, shall be manufactured without holes.

B. Adhesive: Adhesive for anchoring bumpers or wheel stops to pavement shall be an epoxy adhesive manufactured for the purpose, similar and equal to the adhesives of Superior Industries Inc. #303 Bumper Mount 1-800-476-2072

C. Steel Bars for Installation: Epoxy-coated rebar, No. 5 size, conforming with applicable requirements of Section 03 20 00 - Concrete Reinforcing.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Precast concrete bumpers shall be anchored and secured in position on at-grade asphalt pavements, as indicated, with two No. 5 epoxy-coated rebar and secure bumper with Superior Industries Inc. #303 Bumper Mount epoxy adhesive as specified in Article 2.01.B herein.

B. Precast concrete bumpers shall be secured in position on at-grade concrete pavements, as indicated, with an appropriate epoxy adhesive as specified in Article 2.01.B herein.

END OF SECTION 32 17 13

SECTION 32 17 23 PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Traffic line paint material for traffic striping and marking.

B. Application of traffic striping and control markings.

C. Application of striping for crosswalks and handicapped symbol.

D. Application of striping for parking stalls.

E. Application of fire lane striping

1.02 RELATED SECTIONS

A. Asphalt pavement is specified in Section 32 12 16 - Asphalt Paving.

B. Concrete pavement is specified in Section 32 13 13 - Concrete Paving.

C. Concrete curbs, gutters, and walks are specified in Section 32 16 21 - Concrete Curbs, Gutters, and Walks.

D. Thermoplastic Pavement Marking is specified in Section 32 17 23.33 - - Thermoplastic Pavement Markings.

E. All other painting is specified under Division 9, Finishes.

1.03 REFERENCES

A. State of Texas, Department of Transportation (TxDOT), Standard Specifications, latest edition:

1. Section 666 Reflectorized Pavement Markings

2. Latest regulations governing permissible content of Volatile Organic Compounds (VOC) in paints

1.04 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Shop Drawings: Submit drawings and diagrams, indicating stripe width of roadway divider stripes and parking stalls, configuration and dimensions of directional arrows, style and size of letters for "compact car" designation, configuration and dimensions of international handicapped symbol, and any other traffic control markings on pavement, such as "in" and "out" or "enter" and "exit" designations as indicated.

C. Certificate of Compliance: Submit evidence or affidavit that certifies that paint to be used complies with latest VOC regulations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Paint Material: Provide paint material conforming to the requirements of Section 666 of the TxDOT Standard Specifications, colors as indicated on Drawings.

1. Provide glass beads where indicated on Drawings.

B. Stall Numbers: Pre-cut thermoplastic numbers, 90 mil minimum thickness. Numbers shall be yellow, 12 inches high, Helvetica Light font where indicated on Drawings

2.02 SCHEDULE

A. Parking spaces shall be delineated by 4" solid white lines. Handicapped symbols shall be approximately 5' by 5' white paint using the guide as shown on the drawings. Handicapped striping shall be 12" wide solid white stripes. Cross walk striping shall be white striping as shown on the drawings. Fire lanes shall consist of red paint on the curb and gutter and an 8" wide stripe painted on the pavement where fire lane is not adjacent to curb and gutter. White lettering 4" minimum height and reading "FIRE LANE - NO PARKING" shall be stenciled on the curb face or centered on the flat 8" wide stripe. The stenciled lettering shall be at 20' on center. Fire lanes shall be as required by the Local County or City Fire Department, Contractor shall verify locations prior to proceeding with the fire lane painting.

PART 3 - EXECUTION

3.01 APPLICATION

A. Apply no paint until pavement has cured for at least 3 days or for the number of days as recommended by the manufacturer, whichever is longer. Ensure that pavement has cured sufficiently to carry application equipment without damage.

B. Provide traffic striping and control markings on pavement, parking stalls, and curbs in accordance with the layout, configurations, and dimensions indicated on the Contract Drawings and approved Shop Drawings.

C. Application equipment and procedures shall conform to the applicable requirements of the TxDOT Standard Specifications. Keep paint thoroughly mixed throughout application.

D. Traffic control markings and parking stalls shall be applied with the use of substantial cutout patterns and templates, or with striping equipment that applies straight, uniform width, sharp lines. Coverage shall be thorough and complete in accordance with the paint and thermoplastic manufacturer's instructions and recommendations and the TxDOT Standard Specifications.

1. Provide one coat for painted striping and pavement markings. Application rate per coat shall match that specified in the TxDOT Standard Specifications.

2. Apply thermoplastic material at a minimum thickness of 0.125 inch or at the manufacturer’s recommended minimum thickness, whichever is greater.

E. Traffic control markings and parking stalls shall be sharp and accurate, straight where required, without fuzziness at edges of lines.

F. Accessible parking stalls shall include the International Symbol for Accessibility.

G. At completion, the Contractor shall check the work thoroughly and shall touchup traffic control markings and parking stalls that are not distinct or thorough in coverage, or are not uniform in color.

3.02 TOLERANCES AND APPEARANCE

A. In addition to the tolerances and appearance requirements specified in the TxDOT Standard Specifications, edges shall be uniform with local variations not exceeding 1/8 inch per foot and surfaces shall be smooth and uniform.

B. Letter sizes and patterns shall be as indicated on the Contract Drawings with variations of not more than plus or minus 15

percent in dimension.

3.03 GENERAL

A. The Contractor shall use a crew experienced in the painting of pavement markings.

3.04 PREPARATION

A. The pavement surface to receive the pavement markings shall be thoroughly cleaned of all dirt, organic growth or other material that will prevent adhesion of the paint to the surface. The pavement shall be allowed to cure for a period of at least 15 days of hot weather or 30 days of cold weather. Pavement markings which do not thoroughly adhere to the asphalt and or concrete will NOT be accepted and will have to be redone to the satisfaction of the Architect/Engineer.

3.05 RATE OF APPLICATION

A. Paint shall be applied at a rate to yield a consistent wet film thickness of not less than 15 but not more than 20 mils.

3.06 PROTECTION

A. Applied markings shall be protected from traffic until they have dried sufficiently so as to not be damaged or tracked by normal traffic movements.

3.07 SCHEDULE OF PAINTING

A. Parking Lot striping and handicapped symbol for all new pavement shall be yellow paint whereas shown on the drawings. Contractor shall remove existing striping by painting with dark gray paint.

B. Fire lanes shall be as designated on the drawings and/or as required by the City or County Fire Department.

C. All striping in public roads shall be painted with thermoplastic paint. Contractor to stripe where shown on the drawings.

END OF SECTION 32 17 23

SECTION 32 91 19.13 SPREADING AND GRADING TOPSOIL

PART 1 – GENERAL

1.01 RELATED SECTIONS

1. Section 31 11 00 - Clearing and Grubbing.
2. Section 31 22 13 - Rough Grading.

1.02 QUALITY ASSURANCE

1. Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
3. Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.03 SOURCE QUALITY CONTROL

1. Advise Owner's Representative of sources of topsoil to be utilized 7 days in advance of stating time.
2. Contractor is responsible for soil analysis and requirements for amendments to supply topsoil as specified.
3. Soil testing by recognized testing facility for PH, P and K, and organic matter.

1.04 PROTECTION

A. Prevent damage to existing trees to remain, benchmarks, pavement and utility lines. Correct damage at no cost to owner.

PART 2 - PRODUCTS

2.01 TOPSOIL

1. Topsoil for seeded areas: mixture of mineral particulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.
    a. Soil texture based on The USGS System of Soil Classification, to consist of 40% to 60% sand, 12-27% clay, and contain 2 to 10 % organic matter by weight.
    b. Contain no toxic elements or growth inhibiting materials.
    c. Free from:
        (1) Debris and stones over 2 inches in diameter
        (2) Course vegetative material, 2 inches in diameter and 4 inch length, occupying more than 2% of soil volume.
    d. Consistence: friable when moist.
    e. pH between 6.0 and 7.0

2.02 SOIL AMENDMENTS

A. Fertilizer:

1. Fertility: major soil nutrients present in following amounts:

2. Nitrogen (N): 20 to 40 micrograms of available N per gram of topsoil.

3. Phosphorus (P): 40 to 50 micrograms of phosphate per gram of topsoil.

4. Potassium (K): 75 to 110 micrograms of potassium per gram of topsoil.

5. Calcium, magnesium, sulfur and micro-nutrients present in balanced ratios to support germination and/or establishment of intended vegetation.

6. Ph value: 6.5 to 8.0.

B. Peatmoss:

1. Derived from partially decomposed species of Sphagnum Mosses.

2. Elastic and homogeneous, brown in colour.

3. Free of wood and deleterious material which could prohibit growth.

4. Shredded particle minimum size: 5 mm.

C. Sand: washed coarse silica sand, medium to course textured.

D. Limestone:

1. Ground agricultural limestone.

2. Gradation requirements: percentage passing by weight, 90% passing 1.0 mm sieve, 50% passing 0.125 mm sieve.

E. Fertilizer: industry accepted standard medium containing nitrogen, phosphorous, potassium and other micro-nutrients suitable to specific plant species or application or defined by soil test.

PART 3 – EXECUTION

3.01 STRIPPING OF TOPSOIL

1. Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

2. Commence topsoil stripping of areas as indicated after area has been cleared of brush weeds and grasses and removed from site.

3. Strip topsoil to depths as indicated. Avoid mixing topsoil with subsoil where textural quality will be moved outside acceptable range of intended application.

4. Stockpile in locations as directed by Owner's Representative or where shown on the plans. Stockpile height not to exceed 10 feet

5. Disposal of unused topsoil as directed by Owner's Representative.

6. Protect stockpiles from contamination and compaction

.

3.02 PREPARATION OF EXISTING GRADE

1. Verify that grades are correct. If discrepancies occur, notify Owner's Representative and do not commence work until instructed by Owner's Representative.

2. Grade soil, eliminating uneven areas and low spots, ensuring positive drainage.

3. Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 75 mm above surface. Dispose of removed material off site.

4. Coarse cultivate entire area which is to receive topsoil to minimum depth of 6 inches. Cross cultivate those areas where equipment used for hauling and spreading has compacted soil.

3.03 PLACING AND SPREADING OF TOPSOIL/PLANTING SOIL

1. Place topsoil after Owner's Representative has accepted subgrade.

2. Spread topsoil in uniform layers not exceeding 6 inches, over unfrozen subgrade free of standing water.

3. For sodded areas keep topsoil 2 inches below finished grade.

4. Spread topsoil as indicated to following minimum depths after settlement and 80% compaction:

   a. 6 inches for seeded areas

   b. 5 inches for sodded areas.

   c. 12 inches for shrub beds

5. Manually spread topsoil/planting soil around trees, shrubs and obstacles.

6. After spreading, any large, stiff clods and hard lumps shall be broken with a pulverizer or by other effective means, and all stones or rocks (2 inches or more in diameter), roots, litter, or any foreign matter shall be raked up and disposed of by the Contractor. After spreading is completed, the topsoil shall be satisfactorily compacted by rolling with a cultipacker or by other means approved by the Owner's representative. The compacted topsoil surface shall conform to the required lines, grades and cross-sections. Any topsoil or other dirt falling upon pavements as a result of hauling or handling of topsoil shall be promptly removed.

7. If there is an excess of topsoil, the Contractor shall transport the excess topsoil to and place material at a properly permitted dump site.

3.04 FINISH GRADING

1. Grade to eliminate rough spots and low areas and ensure positive drainage. Prepare loose friable bed by means of cultivation and subsequent raking.

2. Consolidate topsoil to required bulk density using equipment approved by Owner's Representative. Leave surfaces smooth, uniform and firm against deep footprinting.

3.05 ACCEPTANCE

1. Owner's Representative will inspect and test topsoil in place and determine acceptance of material, depth of topsoil and finish grading. Approval of topsoil material subject to soil testing and anaylsis.

2. Testing of topsoil will be carried out by testing laboratory designated by Owner's Representative. Soil sampling, testing and analysis to be in accordance with TxDOT regulations and standards. Contractor will pay for cost of

tests as specified in Section 01 45 00 – Quality Control.

3.06 RESTORATION OF STOCKPILE SITES

1. Restore stockpile sites acceptable to Owner's Representative.

3.07 SURPLUS MATERIAL

1. The contractor shall dispose of excess materials at a permitted dump site. Contractor to maintain records of where the excess material was disposed at.

3.08 CLEANING

1. Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION 33 40 00

SECTION 32 92 02 SODDING

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes:

1. Sodding.

1.02 REFERENCES

A. Hortus III – 1976 Edition, Bailey Hortorium, Cornell University.

B. Guideline Specifications to Turfgrass Sodding – 1995 Edition, By Turfgrass Producers International

1.03 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

E. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification of grass sod.

1. Certification of each seed mixture for turf grass sod.

C. Product certificates.

D. Planting Schedule: Indicating anticipated planting dates for each type of planting.

1.05 QUALITY ASSURANCE

A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.

1. Report suitability of topsoil for lawn growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to requirements in TPI's "Specifications for Turfgrass Sod

Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in its "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

1.07 PROJECT CONDITIONS

A. Do not install lawns during rainy or freezing weather, or when soil is frozen.

1.08 TIMING OF INSTALLATION

A. Sod:

1. Immediately after finish grading is accepted.

2. Allow sufficient time for sod to knit together and meet requirements for preliminary review.

1.09 WARRANTY

A. Time Period: Warrant that lawns are in healthy and flourishing condition of vigroious active growth one year from date of Final Acceptance.

B. Appearance during Warranty: Lawns shall be free of dead or dying patches, and all areas shall show foliage of a normal density, size and color.

C. Delays: Delays caused by the Contractor in completing planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.

D. Exceptions: Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, or Acts of God during Warranty Period. Report such conditions in writing.

1.10 MAINTENANCE SERVICE

A. Initial Lawn Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days from date of planting completion.

a. When initial maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

2. Sodded Lawns: 30 days from date of planting completion.

PART 2 - PRODUCTS

2.01 LAWN SOD

A. One year old nursery-grown sod that is certified Common Bermuda.

B. Dense, healthy, field-grown on fumigated soil with the grass having been mowed at 1-inch height before lifting from field.

C. Dark green in color, free of thatch, free from diseases, weeds and harmful insects.

D. Reasonably free of objectionable grassy and broad leaf weeds. Sod shall be considered weed free if no more than ten (10) such weeds are found per 100 sq. ft. of sod.

E. Sod shall be rejected if found to contain the following weeds:

1. Quackgrass.

2. Johnson grass.

3. Poison ivy.

4. Nimbleweed.

5. Thistle.

6. Bindweed.

7. Bentgrass.

8. Perennial sorrel.

9. Bromegrass.

F. All sod to be cut 1-1/2 inches deep. Rhizome development should be apparent.

2.02 GENERAL ACCESSORIES

A. Water: Potable water as furnished by Contractor.

B. Pre-plant Fertilizer: See Spreading and Grading of Top Soil Section 32 91 19.13

C. Top-Dress Fertilizer: 16-6-8 (N-P-K)

D. Herbicides: Do not use herbicides which persist in the ground longer than 30 days.

PART 3 - EXECUTION

3.01 3.1 EXAMINATION

A. Verification of Conditions:

1. Grades: Verify that grades are within 1-inch plus or minus the required finished grades. Verify that all soil preparation has been completed and approved. Report all variations in writing.

2. Stones, Weeds, Debris: Verify that all areas to receive lawns and grasses are clear of stones larger than 1 inch in diameter, weeds, debris, and other extraneous materials.

3.02 PREPARATION

A. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

B. Before planting, restore areas if eroded or otherwise disturbed after finish grading.

3.03 SODDING

A. A. Sod Bed Preparation:

1. Rolling: Roll amended soil with 200 pound water-ballast roller.

2. Moistening Soil Surface: After all unevenness in the soil surface has been corrected, lightly moisten the soil immediately prior to laying the sod.

3. Timing: Sod immediately thereafter, provided the sod bed has remained in friable condition.

B. B. Sodding Operations :

1. Big roll sod shall be installed by tractors with proper flotation tires of by an approved big roll sod installation machine. Care should be taken to roll out sod at a proper speed so that no humping or tearing of sod occurs. Sod will be manually pulled together by stiff rakes to insure no gaps remain in the seams. Joints should be staggered. Damaged or problem areas shall be cut out and replaced in a professional matter.

2. Starter Strip:

a. Lay first row of sod in a straight line, with subsequent rows parallel to and tightly against each other.

b. Stagger lateral joints.

c. Do not stretch or overlap sod.

d. Butt all joints tightly to eliminate all voids.

3. Cutting: Use a sharp knife to cut sod to fit curves, surface components of the irrigation system or other items.

4. Tamping and Rolling: Thoroughly tamp and roll sod to make contact with sod bed. Roll each entire section of completed sod.

5. Watering: Thoroughly water sod immediately after installation to wet the underside of the new sod pad and the soil immediately below to a depth of 6 inches. Maintain constant moisture for 2 weeks or until sod is fully rooted.
6. Top-Dress Fertilizer: Apply at the rate of (6) to (8) pounds per 1,000 square feet at 25 days and at 50 days after sodding.

3.04 LAWN MAINTENANCE

A. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, re-grade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth lawn. Provide materials and installation the same as those used in the original installation. B. Mow lawn as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowing.

3.05 SATISFACTORY LAWNS

A. Satisfactory Sodded Lawn: At end of maintenance period, a healthy, well-rooted, even-colored, viable lawn has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

3.06 FIELD QUALITY CONTROL

A. Tests: Samples of materials may be taken and tested for conformity to specifications at any time.

B. Rejected Materials: Remove rejected materials immediately from site at Contractor's expense. Pay cost of testing of materials not meeting specified requirements.

3.07 CLEANING

A. Erosion: Immediately restore eroded areas. Keep all adjacent paved surfaces clear of dirt, mud, stains, and organic debris.

END OF SECTION 32 92 02

SECTION 32 92 19.16 HYDRAULIC SEEDING

PART 1 - GENERAL

1.01 DESCRIPTION

This section governs the seeding and hydromulching and or sodding of all non-paved areas in the entire area disturbed by the contractor at the site.

1.02 RELATED SECTIONS

A. Section 01 33 00 - Submittal Procedures.

B. Section 31 22 13 - Rough Grading.

C. Section 32 91 19.13 - Topsoil Placement and Grading.

1.03 DEFINITIONS

A. Stand of grass: 120 growing common Bermuda grass plants per square foot, to be established within two calendar weeks of planting date, on a smooth bed free of foreign material, rocks larger than 2 inches diameter and weeds.

1.04 SUBMITTALS

A. Provide product data for:

1. Seed

2. Mulch

3. Tackifier

4. Fertilizer

B. Submit in writing to Owner's Representative seven (7) days prior to commencing work:

1. Volume capacity of hydraulic seeder in gallons

2. Amount of material to be used per tank based on volume.

3. Number of tank loads required per hectare to apply specified slurry mixture per acre.

C. Test Reports: Results of seed purity and germination tests.

D. Certificates: Manufacturer's certification that seed meets specification requirements.

E. Maintenance Instructions: Submit to the Owner's Representative prior to the final inspection.

F. Provide the Owner's Representative with copies of all delivery tickets for products covered by this section.

G. Provide samples of hay for mulching for examination by the Owner's Representative.
1.

1.05 QUALITY ASSURANCE

A. Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

B. Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

C. Pre-Installation Meetings: conduct pre-installation meeting to verify project requirements, installation instructions and warranty requirements.

1.06 SCHEDULING

A. Schedule hydraulic seeding to coincide with preparation of soil surface.

1.07 WARRANTY

A. All areas hydroseeded under this contract shall have a warranty period of one (1) year from the date of Certificate of Substantial Performance shall cover any defects in materials and workmanship or damages caused by the elements of weather. All defects shall be repaired to the satisfaction of the Owner's Representative at no cost to the Owner.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Seed

B. Summer Seeding

1. Species: Hulled Bermuda grass (Cynodon dactylon) of 98% purity.

2. Germination rate: 90%

3. Clean, dry, new crop seed.

4. Free of all weeds.

5. Seed between calendar dates of March 2 and September 1.

C. Winter Seeding

6. Species: Annual Rye and unhulled Bermuda grass, each of 98% purity.

7. Germination rate: 90%.

8. Clean, dry, new crop seed.

9. free of all weeds

10. Seed between calendar dates of September 2 and March 1.

D. Contractor to submit mixture composition to Owner's Representative for approval.

E. Mulch: specially manufactured for use in hydraulic seeding equipment, non-toxic, water activated, green colouring, free of

germination and growth inhibiting factors with following properties:

1. Type I mulch:

   a. Made from wood cellulose fibre
   .

   b. Organic matter content: 95% plus or minus 0.5%.

   c. Value of pH: 6.0.

   d. Potential water absorption: 800-900%.

2. Type II mulch:

   a. Made from newsprint, raw cotton fibre and straw, processed to produce fibre lengths of 15 mm minimum and 25 mm maximum. Greater proportions of ingredients to be straw.

F. Tackifier: water dilutable, liquid dispersion.

G. Water: free of impurities that would inhibit germination and growth.

H. Fertilizer:

1. Uniform composition.

2. Pelletized.

3. Containing following percentage of plant food by weight, as indicated on the bag or container:

a.	Nitrogen:		15%	or	Nitrogen 15%
b.	Phosphoric Acid:	4%	or		Phosphoric Acid: 5%
c.	Potash:	8%	or		Potash: 10%

4. The fertilizer shall be delivered to the site in bags or other convenient containers, each fully labeled conforming to the applicable state fertilizer laws, and bearing the name, trade name or trademark, ratio of nutrients (N-P-K), and warranty of the producer.

PART 3 – EXECUTION

3.01 WORKMANSHIP

A. Do not spray onto structures, signs, guide rails, fences, plant material, utilities and other than surfaces intended.

B. Clean-up immediately, any material sprayed where not intended, to satisfaction of Owner's Representative.

C. Do not perform work under adverse field conditions such as wind speeds over 10 km/h, frozen ground or ground covered with snow, ice or standing water.

D. Protect seeded areas from trespass until plants are established.

3.02 PREPARATION OF SURFACES

A. Fine grade areas to be seeded free of humps and hollows. Ensure areas are free of deleterious and refuse materials.

B. Cultivated areas identified as requiring cultivation to depth of 25 mm.

C. Ensure areas to be seeded are moist to depth of 150 mm before seeding.

D. Obtain Owner's Representative approval of grade and topsoil depth before starting to seed.

3.03 FERTILIZING PROGRAM

A. Fertilize prior to fine grading incorporating fertilizer equally distributed in accordance with an agreed program between Contractor and Owner's Representative.

B. Fertilize during establishment and warranty periods to an agreed program between Contractor and Owner's Representative.

3.04 PREPARATION OF SLURRY

A. Measure quantities of materials by weight or weight-calibrated volume measurement satisfactory to Owner's Representative. Supply equipment required for this work.

B. Charge required water into seeder. Add material into hydraulic seeder under agitation. Pulverize mulch and charge slowly into seeder.

C. After all materials are in the seeder and well mixed, charge tackifier into seeder and mix thoroughly to complete slurry.

3.05 SLURRY APPLICATION

A. Hydraulic seeding equipment:

1. Slurry tank.

2. Agitation system for slurry to be capable of operating during charging of tank and during seeding, consisting of recirculation of slurry and or mechanical agitation method.

3. Pumps capable of maintaining continuous non-fluctuating flow of solution.

4. Supplied with not less than 6 spray pattern nozzles.

5. Capable of seeding by 50 m hand operated hoses and appropriate nozzles.

6. Tank volume to be certified by certifying authority and identified by authorities "Volume Certification Plate".

B. Slurry mixture applied per hectare.

1. Seed: Grass mixture 150 kg.

2. Mulch: Type I 1250 kg.

3. Tackifier: 20 kg.

4. Water: Minimum 30,000 L.

5. Fertilizer: 600 kg, ratio 5-20-20.

C. Apply slurry uniformly, at optimum angle of application for adherence to surfaces and germination of seed.

1. Using correct nozzle for application.

2. Using hoses for surfaces difficult to reach and to control application

D. Blend application 300 mm into adjacent grass areas or sodded areas to form uniform surfaces.

E. Re-apply where application is not uniform.

F. Remove slurry from items and areas not designated to be sprayed.

G. Protect seeded areas from trespass satisfactory to Owner's Representative.

H. Remove protection devices as directed by Owner's Representative.

3.06 MAINTENANCE DURING ESTABLISHMENT PERIOD

A. Perform following operations from time of seed application until acceptance by Owner's Representative.

B. Grass Mixture:

1. Repair and reseed dead or bare spots to allow establishment of seed prior to acceptance.

2. Mow grass to 2 inches whenever it reaches height of 3 inches. Remove clippings which will smother grass as directed by Owner's Representative.

3. Fertilize seeded areas 10 weeks after germination provided plants have mature true leafs in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles; water in well.

4. Control weeds by manual, mechanical or chemical means. Utilizing acceptable integrated pest management practices.

5. Water seeded area to maintain optimum soil moisture level for germination and continued growth of grass. Control watering to prevent washouts.

3.07 ACCEPTANCE

A. Seeded areas will be accepted by Owner's Representative provided that:

1. Plants are uniformly established. Seeded areas are free of rutted, eroded, bare or dead spots.

2. Areas have been mown at least twice.

3. Areas have been fertilized.

B. Areas seeded in fall will achieve final acceptance in following spring, one month after start of growing season provided acceptance conditions are fulfilled.

3.08 MAINTENANCE DURING WARRANTY PERIOD

A. Perform following operations until acceptance of Certificate of Total Performance.

1. Water seeded area to maintain optimum soil moisture level for continued growth. Control watering to prevent washouts.

2. Repair and reseed dead or bare spots to satisfaction of Owner's Representative.

3. Mow areas seeded, remove clippings, as directed by Owner's Representative.

4. Fertilize seeded areas in accordance with fertilizing program. Spread half of required amount of fertilizer in one direction and remainder at right angles and water in well.

5. Eliminate weeds by mechanical or chemical means.

6. At the end of the warranty period repeat items 2-5.

3.09 CLEANING

A. Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION 32 92 19.16

DIVISION 33 – UTILITIES

SECTION 33 01 30 TESTING OF GRAVITY SEWER SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This is a general specification, which applies to the furnishing of all labor, materials, tools, and equipment to perform all operations in connection with leakage testing for completed manholes and gravity sewer pipe and deflection testing for flexible sewer pipe.

1.02 MEASUREMENT AND PAYMENT

A. Testing of sewer lines, manholes and appurtenances shall not be considered a separate pay item. The Contractor shall supply all water for the tests, all equipment and labor necessary to convey the water into the sewer, the necessary transportation to transport test plugs and risers from one test site to another and such labor and equipment as may be required in installing test plugs, and other incidental work in conducting the tests and the cost thereof shall be included in the price for constructing the sewer, including furnishing the test plugs.

PART 2 – PRODUCTS

2.01 TESTING REQUIREMENTS

A. MANHOLE TESTING

After completion of manhole construction, wall sealing, or rehabilitation, test manholes for leakage using Vacuum Testing or, if pre-approved by the Engineer, Exfiltration Testing Procedures as specified herein.

1. General: Plug influent and effluent lines, including service lines, with suitably sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required in this test; follow Manufacturer's safety and installation recommendations. Place plugs a minimum of 6 inches outside of manhole walls.

2. Vacuum Testing

   a. To perform a vacuum test, all lift holes and exterior joints shall be plugged with a non-shrink grout and all pipes entering a manhole shall be plugged.

   b. No grout must be placed in horizontal joints before testing.

   c. Stub-outs, manhole boots, and pipe plugs must be secured to prevent movement while a vacuum is drawn.

   d. Contractor shall use a minimum 60 inch/lb torque wrench to tighten the external clamps that secure a test cover to the top of a manhole.

   e. A test head must be placed at the inside of the top of a cone section, and the seal inflated in accordance with the manufacturer's recommendations.

   f. There must be a vacuum of 10 inches of mercury inside a manhole to perform a valid test.

   g. A test does not begin until after the vacuum pump is off.

   h. A manhole passes the test if after 2.0 minutes and with all valves closed, the vacuum is at least 9.0 inches of mercury.

3. Hydrostatic Testing

a. The maximum leakage for hydrostatic testing or any alternative test methods is 0.025 gallons per foot diameter per foot of manhole depth per hour.

b. Seal all wastewater pipes coming into a manhole with an internal pipe plug, fill the manhole with water up to the manhole cover and maintain the test for at least one hour.

c. A test for concrete manholes may use a 24-hour wetting period before testing to allow saturation of the concrete.

B. Gravity Pipe Leakage Testing

1. General Tests shall be made by the low-pressure air test, the infiltration test or the joint test. The infiltration test shall be used when the groundwater level is at least 2 ft above the crown of the pipe measured at the upstream manhole. The joint test shall be used for pipe sections greater than 36-inch inside diameter. The Contractor may use the joint test for pipe with a 27-inch through 36-inch average inside diameter at the approval of the Engineer or his representative. The low-pressure air test, the infiltration test and the exfiltration test shall be conducted from manhole to manhole. Trenches shall be completely backfilled and sewer line should be free of debris prior to testing. Plug all pipe outlets including laterals and secure plugs to prevent leakage blowout due to testing pressure.

2. Infiltration Test

a. Performance: The total infiltration, as determined by a hydrostatic head test, shall not exceed 50 gallons per inch of diameter per mile of pipe per 24 hours at a minimum test head of 2.0 feet above the crown of a pipe at an upstream manhole. For construction within the 100-year flood plain, the total infiltration shall not exceed ten gallons per inch of diameter per mile of pipe per 24 hours.

NORMAL CONSTRUCTION

Size of Pipe	Allowable Leakage* Gal /Min/100Ft.
6”	0.0039
8”	0.0053
10”	0.0066
12”	0.0079
15”	0.0099
18”	0.0118
21”	0.0138

Equivalent to 50 gal. per inch diameter per mile per 24 hours

CONSTRUCTION WITHIN 100 YR FLOOD PLAIN

Size of Pipe	Allowable Leakage* Gal /Min/100Ft.
6”	0.0008
8”	0.0011
10”	0.0013
12”	0.0016
15”	0.0020
18”	0.0024
21”	0.0028

* Equivalent to 10 gal. per inch diameter per mile per 24 hours

b. The total leakage in cubic inches shall be the total cross-sectional area in square inches of the inside

of the two risers and of any stacks in the sewer multiplied by the drop in water level in inches. For diameters not listed in chart, multiply the square of the diameter by the following chart value for 1" diameter.

Diameter of Riser or Stack	Volume Per Inch of Depth	
	Cubic Inch	Gallon
1”	0.7854	0.0034
2”	3.1416	0.0136
2-1/2”	4.9087	0.0212
3”	7.0686	0.0306
4”	12.5664	0.0544
5”	19.6350	0.0850
6”	28.2743	0.1224
8”	50.2655	0.2176

d. Execution: Stop all dewatering operations and allow the groundwater to return to its normal level and allow to remain so for at least 24 hours. Leakage shall be determined by measuring the flow through the opening in the downstream plug for at least 15 minutes. Five separate measurements shall be made. The average of the measurements shall be used, discarding any one of the five measurements except the last that varies by more than 50% from the average of the other four. If the results of the tests are otherwise satisfactory, but the last of the five measurements show leakage in excess of that permitted, the tests shall be continued to determine if additional leaks may have developed during testing.

3. Air Test

a. Performance: The pipe shall be pressurized to 5 pounds per square inch gauge (psig) greater than the pressure exerted by groundwater above the pipe. Once the pressure is stabilized, the minimum time allowable for the pressure to drop 1.0 psig shall be 5 minutes per every 100 feet of pipe plus (+) 5 minutes per each service connection. Pipe sizes larger than 27 inches shall be tested as per TCEQ requirements.

b. The test may be stopped if no pressure loss has occurred during the first 25% of the calculated testing time. If any pressure loss or leakage has occurred during the first 25% of the testing period, then the test shall continue for the entire test duration as outlined in this subparagraph or until failure.

c. Execution: Add air until the internal air pressure of the sewer line is raised to approximately 5.5 psig. Allow the air pressure to stabilize. The pressure will normally drop until the temperature of the air in the line stabilizes.

d. When the pressure has stabilized and is at or above the starting test pressure of 5 psig, commence the test by allowing the gage pressure to drop to 5 psig at which point the time recording is initiated. Record the drop in pressure for the test period.

4. Joint Test

a. The joint test may be conducted by an air test or water test. The joint and the pipe segment shall be visually inspected immediately after testing.

b. Performance: The pipe is to be pressurized to 3.5 psig greater than the pressure exerted by groundwater above the pipe. Once the pressure has stabilized, the minimum time allowable for the pressure to drop from 3.5 psig to 2.5 psig shall be ten seconds.

c. If the groundwater pressure is equal to or greater than 3.5 psig, and the sewer line or joint is not leaking the sewer line or joint is acceptable and no additional testing is required. If one or more joints are leaking, but the total amount of leakage in the sewer line being tested is equal to, or less than, the allowable leakage specified in 250.03-B-1 “Performance”, the line is acceptable and no additional testing is required provided visible leaks are repaired. Moisture or beads of water appearing on the surface of the joint will not be considered as visible leakage.

d. Execution: Review proper operation, safety, and maintenance procedures as provided by the manufacturer of the joint test apparatus. Move the joint test apparatus into the sewer line to the joint to be tested and position it over the joint. Make sure the end element sealing tubes straddle both sides of the joint and the hoses are attached. For the water test, the bleed-off petcock must be located at top dead center. Inflate end element sealing tubes with air in accordance with equipment and manufacturer's instructions.

e. Air Test - Pressurize the void volume with air to 3.5 psig greater than the pressure exerted by groundwater above the pipe. The drop in pressure shall be measured over ten seconds. Five separate measurements shall be made. The average of the measurements shall be used, discarding any one of the five measurements except the last that varies by more than 50% from the average of the other four. If the results of the tests are otherwise satisfactory, but the last of the five measurements show leakage in excess of that permitted, the tests shall be continued to determine if additional leaks may have developed during testing.

f. Water Test - Introduce water into void volume until water flows evenly from open petcock. Close the petcock and pressurize with water to 3.5 psig above the pressure exerted by ground water. The drop in pressure shall be measured over ten seconds. Five separate measurements shall be made. The average of the measurements shall be used, discarding any one of the five measurements except the last that varies by more than 50% from the average of the other four. If the results of the tests are otherwise satisfactory, but the last of the five measurements show leakage in excess of that permitted, the tests shall be continued to determine if additional leaks may have developed during testing.

C. DEFLECTION TESTING

1. Deflection tests shall be performed on all flexible pipes. For pipelines with inside diameters less than 27 inches, a rigid mandrel shall be used to measure deflection. For pipelines with an inside diameter 27 inches and greater, a method pre-approved by the Engineer shall be used to test for vertical deflections. Other methods shall provide a precision of two tenths of one percent (0.2%) deflection. The test shall be conducted after the final backfill has been in place at least 30 days. No pipe shall exceed a deflection of 5.0%. If a pipe should fail to pass the deflection test, the problem shall be corrected and a second test shall be conducted after the final backfill has been in place an additional 30 days. The tests shall be performed without mechanical pulling devices.

2. Mandrel Sizing

a. The rigid mandrel shall have an outside diameter (O.D.) equal to 95% of the inside diameter (I.D.) of the pipe. The inside diameter of the pipe, for the purpose of determining the outside diameter of the mandrel, shall be the average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and the average inside diameter for I.D. controlled pipe. All dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

3. Mandrel Design

a. The rigid mandrel shall be constructed of a metal or rigid plastic material that can withstand 200 psi without being deformed. The mandrel shall have nine or more "runners" or "legs" as long as the total number of legs is an odd number. The barrel section of the mandrel shall have a length of at least 75% of the inside diameter of the pipe. A proving ring shall be provided and used for each size mandrel in use.

4. Method Options

a. Adjustable or flexible mandrels are prohibited. A television inspection is not a substitute for the deflection test. A deflectometer may be approved for use on a case-by-case basis. Mandrels with

removable legs or runners may be accepted on a case-by-case basis. Mechanical devices will not be used to pull the mandrel.

D. TV CAMERA INSPECTION

1. T.V. Camera Inspection shall be performed on all sewer pipe installed before acceptance. When the Contractor performs the inspection, the Engineer or his representative shall be notified one working day prior so that he can view the procedure. The inspection shall be in digital video format, saved to a DVD or CD (enclosed within a protective case) and shall be given to the Engineer or his representative for review and final records.

2. The lines shall be completely filled with potable water between manholes to fill the service connections and drained prior to T.V. Camera Inspection. Line shall be cleaned prior to T.V. inspection. All dirt/debris, including pipe grease, in the line which could cover a defect shall be removed. Line should be cleaned before being filled with water. Jetting of the lines in conjunction with the T.V. Inspection is prohibited. If the line to be televised is discovered to contain foreign material, which prohibits an acceptable T.V. inspection, the line shall be jetted and televised again.

3. Select and use closed circuit television equipment that will produce a color digital video. Produce and use closed circuit television equipment using a panorama tilt, radial viewing, pipe inspection camera that pans plus and minus 75 degrees, rotates 360 degrees, and has optical zoom from 6 or less inches to infinity. The camera must have an accurate footage counter accurate to within 1 foot per 500 foot of pipe. Footage shall be continuously displayed on the video at all times. The camera operator shall pause at each tee, tilt camera and view up into the branch for inspection of joints and fittings maintaining a clear in focus picture at all times while zooming to the full extent of the camera. The camera operator shall stop at each fitting and change in pipe type and complete a 360 degree view of the fitting slow enough to identify all defects. Glare shall be avoided and shall not interfere with viewing the pipe segment. Maximum rate of travel for the camera shall be 30 feet per minute. DVDs or CDs shall be continuous from pipe segments between manholes. Provide DVDs or CDs with labels indicating project number, segment number, date televised, date submitted, starting manhole number, ending manhole number, pipe diameter, pipe length and street name.

4. The T.V. inspection shall be used to identify defective construction such as sags, debris, separated joints, etc. The Engineer shall make all final determinations if the severity of the defect constitutes failure and subsequent removal of the segment in question.

E. RETESTS

5. Manholes or sewers which fail to meet the testing requirements shall be repaired and retested by the Contractor. All repairs and retesting shall be performed at the expense of the Contractor.

PART 3– EXECUTION

3.01 GENERAL

A. The Contractor shall notify the Engineer or his representative when the manholes and line are ready to be tested. After the Engineer or his representative concurs that the line is ready to be tested, the Contractor may proceed with testing. The Contractor will supply and set-up the test plugs and risers for the test and will perform the test in the presence of the Engineer or his representative.

B. Contractor shall take such precautions as required to prevent damage to lines and appurtenances being tested. Damage resulting from tests shall be repaired at Contractor's expense.

END OF SECTION 02 41 13

SECTION 33 05 16 UTILITY STRUCTURES

PART 1- GENERAL

1.01 SECTION INCLUDES

A. Excavation and backfill

B. Cast-in place concrete structures.

C. Precast concrete structures.

D. Metal components.

1.02 RELATED SECTIONS

A. Concrete formwork, concrete reinforcement, cast-in-place concrete, portland cement concrete, concrete repair and finishing, and precast concrete are specified in the various Sections under Division 3 - Concrete.

B. Interior trench drains and gratings for interior uses are specified in Section 05 50 00 - Metal Fabrication.

C. Ductbanks are specified in Section 20 50 16 - Underground Ductwork and Structures for Facility Services.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A36/A36M Specification for Structural Steel
2. ASTM A48 Specification for Gray Iron Castings
3. ASTM A108 Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
4. ASTM A123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5. ASTM A153 Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6. ASTM A536 Specifications for Ductile Iron Castings
7. ASTM B3 Specification for Soft or Annealed Copper Wire
8. ASTM B26/B26M Specification for Aluminum-Alloy Sand Castings
9. ASTM C33 Specification for Concrete Aggregates
10. ASTM C150 Specification for Portland Cement
11. ASTM C260 Specification for Air-Entraining Admixtures for Concrete
12. ASTM C270 Specification for Mortar for Unit Masonry
13. ASTM C478 Specification for Precast Reinforced Concrete Manhole Sections
14. ASTM C618 Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
15. ASTM C789 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and

Sewers

16. ASTM C850 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 feet of Cover Subjected to Highway

17. ASTM C858 Specification for Underground Precast Concrete Utility Structures

18. ASTM C891 Practice for Installation of Underground Precast Concrete Utility Structures

B. Underwriters Laboratories Inc. (UL):

1. UL 467 Grounding and Bonding Equipment

1.04 SUBMITTALS

A. General: Refer to Section 01 33 00 - Submittal Procedures, and Section 01 33 23 - Shop Drawings, Product Data, and Samples, for submittal requirements and procedures.

B. Shop Drawings: When not indicated on the Contract Drawings in sufficient detail or definition, submit detailed drawings of cast-in-place and precast concrete utility structures and related metal work.

C. Product Data: Submit manufacturers' product data for standard manufactured precast concrete utility boxes and structures and for metal gratings and covers and other, related miscellaneous metal items.

D. Certification: Submit certification or other acceptable evidence that covers and grates to be provided for roadways and parking areas meet proof-testing requirements for H2O and HS2O loadings in accordance with TxDOT Bridge Design Specifications Manual.

PART 2- PRODUCTS

2.01 CAST-IN-PLACE CONCRETE STRUCTURES

A. A. Materials: Comply with requirements of Section 03 05 15 - Portland Cement Concrete, except as specified otherwise herein.

1. Portland Cement: ASTM C150, Type II, low alkali.

2. Cementitious Admixture: Provide fly ash or pozzolan conforming with ASTM C618, Class F or N, not to exceed 15 percent by weight of the cement content.

3. Aggregates: ASTM C33, fine aggregate and Size Nos. 56 or 57 (1-inch maximum size) coarse aggregate.

B. Mix Design: Obtain design of concrete mix as specified in Section 03 05 15 - Portland Cement Concrete, and incorporate the following requirements:

1. Concrete Strength: Class 4000 minimum in accordance with Table 03305-A of Section 03 05 15 - Portland Cement Concrete, except that electrical structures, such as vaults, pull boxes,

2. Maximum water-cement plus pozzolan ratio: 0.45. 3. Maximum slump: 4 inches.

2.02 PRECAST CONCRETE STRUCTURES

A. General: The Contractor may provide precast concrete structures that conform to the general configuration, capacities, and inverts indicated.

B. Fabrication Standards: Comply with requirements of Section 03 40 00 - Precast Concrete, and ASTM C478, ASTM C789,

ASTM C850, and ASTM C858, as applicable, and applicable manufacturers' standards.

C. Materials: Comply with requirements of Section 03 20 00 - Concrete Reinforcing, Section 03 05 15 - Portland Cement Concrete, and Section 03 40 00 - Precast Concrete, except as specified otherwise herein. Provide fine and coarse aggregates conforming to ASTM C33, in size commensurate with structure and reinforcement clearances.

D. Portland Cement Concrete: Class 4000 minimum in accordance with Table 03305-A of Section 03 05 15 - Portland Cement Concrete. Concrete may be polymer or latex modified to achieve higher strengths and denser concrete. Concrete shall not deteriorate from chemical attack of sanitary waste.

1. Concrete for electrical utility structures shall be Class 3000.

E. Precast Covers: Precast covers shall have the utility identification, such as "Gas Valve," stamped into the cover. Certain utility providers have their own specification and requirements for stamped covers. Contractor to consult with utility provider for exact specifications.

F. Quality Control: In accordance with Section 01 45 00 - Quality Control, the Contractor shall perform such inspections and tests as required to verify compliance with these Specifications.

2.03 METAL COVERS, GRATES, AND INLETS

A. Ferrous Castings:

1. Metal used in manufacture of castings shall conform to ASTM A48, Class 35B for Gray Iron, or ASTM A536, Grade 65-45-12 for Ductile Iron.

2. Castings shall be of uniform quality, free from blowholes, shrinkage, distortion or other defects. Castings shall be smooth and cleaned by shotblasting.

3. Minimum tensile strength shall be 35,000 psi.

4. Castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall have continuously machined bearing surfaces to prevent rocking and rattling.

5. Where castings will be subjected to loads of H2O or greater, as indicated, provide ductile iron castings.

B. Aluminum Castings: Where required to reduce weights of larger covers for ease of handling, such covers may be manufactured of aluminum castings conforming to ASTM B26/B26M, Alloy No. 713.0. Minimum tensile strength shall be 32,000 psi.

C. Manhole Covers: Provide cast, manufactured manhole covers and frames with heavy-duty solid cover (lid) or vented cover (lid) as indicated. Covers shall be embossed or engraved with nonslip diamond or square cross-hatched pattern. Provide covers with embossed or engraved word identification, as indicated or appropriate, for the enclosed or underground utility.

D. Grates:

1. Cast Ferrous Grates: Grates for area drains and catch basins shall be heavy-duty, bicycle- safe inlet grates and frames of size and configuration indicated. Grates in roadways and parking areas shall withstand H20 loadings when proof-tested in accordance with TxDOT Design Specifications.

2. Bar-Type Steel Grates: Refer to drawings, for requirements. Bar-type steel gratings will be permitted only in areas where vehicular traffic will not be encountered.

E. Curb and Gutter Inlets: Provide cast, manufactured curb inlet frame, grate, and curb box of size and configuration

indicated. Curb and gutter inlets shall conform to the contour and profile of the concrete curb and gutter. Grates shall be heavy-duty and bicycle-safe and shall withstand H20.

F. Cast Iron Manhole Steps: Provide cast, manufactured manhole steps with cross-hatched treads and with anchor configuration appropriate for cast-in-place concrete or precast concrete as indicated. Provide steps for installation 12 inches on center in vertical alignment.

2.04 MISCELLANEOUS METAL

A. Requirements: Provide channel inserts, pulling eyes, ladders, and electrical grounding rods for electrical manholes and pull boxes as indicated.

B. Steel Materials: Standard structural sections, shapes, plates, bars, and rods, as indicated, conforming with ASTM A36/A36M. Bars conforming with ASTM 108 will be acceptable.

C. Anchors and Bolts: Conform with requirements of Section 05 50 00 - Metal Fabrications, as applicable. Bolts and studs, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A153.
Ladders: Provide standard-manufactured or custom-fabricated steel ladders as required to meet the conditions indicated. Steel ladders shall be hot-dip galvanized after fabrication.

D. Grounding and Bonding Materials: Conform with UL 467 and the following requirements:

1. Grounding Rods: Medium carbon steel core, copper-clad by the molten weld casting process, 3/4-inch diameter by 10 feet long in size.

2. Bare Conductors: ASTM B3, No. 1/0 AWG, Class B stranded, annealed copper conductor.

E. Fabrication: Form and fabricate the work as indicated. Include anchors, fasteners, and accessories to anchor and secure the work in place.

F. Galvanizing: All ferrous metal items shall be galvanized after fabrication by the hot-dip process in accordance with ASTM A123. Weight of the zinc coating shall conform with the requirements specified under "Weight of Coating" in ASTM A123.

2.05 MORTAR

A. Cement mortar for the sealing of openings for pipe penetrations, for cementing of joints of component parts of precast structures, for providing of flow characteristics for the bottoms of drainage structures, and other features as indicated shall conform with the California Building Code, Chapter 21, Type S (without lime), with a minimum compressive strength at 28 days of 1,800 psi.

B. Mortar shall comply with applicable requirements of ASTM C270, including measurement, mixing, proportioning, and water retention. Ten percent by volume of the cement content of the mortar shall be fly ash or pozzolanic material conforming with ASTM C618.

C. Use mortar within 90 minutes after mixing. Discard mortar that has been mixed longer or that has begun to set. Re-tempering of mortar will not be permitted

PART 3 – EXECUTION

3.01 INSTALLATION

A. Requirements: Construct manholes, junction chambers, catch basins, curb and gutter inlets, trench drains, culverts, headwalls, wingwalls, pull boxes, utility boxes and vaults, and related utility structures in connection with the installation of pipe, conduits, ductbanks, and utility trenches, as indicated.

B. Excavation and Backfill: Provide excavation, prepared subgrade and aggregate base, and backfill as specified in Section 31 00 00 - Earthwork, Section 33 05 28 - Trenching and Backfilling for Utilities, Section 32 11 17 - Aggregate Subbase Courses, and Section 32 11 23 - Aggregate Base Course, as indicated.

C. Cast-in-Place Concrete Structures: Provide formwork, steel reinforcement, and concrete in accordance with applicable requirements of Section 03 11 00 - Concrete Forming, Section 03 20 00 - Concrete Reinforcing, and Section 03 30 00 - Cast-In-Place Concrete.

D. Precast Concrete Structures: Install as indicated. Comply with applicable requirements of ASTM C891. Provide such appurtenances and installation accessories, including cement mortar and sealants, as required for a complete installation.

E. Metal Components: Install manhole covers, grates and frames, curb and gutter inlets, metal steps, ladders, channel inserts, pulling eyes, and electrical grounding rods as indicated and in accordance with the respective manufacturer's instructions. Covers and grates in roadways, parking areas, and concrete walks shall be installed flush with adjacent, abutting pavement.

3.02 FIELD QUALITY CONTROL

A. The Contractor shall perform slump tests and strength tests of cast-in-place structures in accordance with the requirements specified in Section 03 05 15 - Portland Cement Concrete.

B. Acceptance of cast-in-place structures will be in accordance with Section 03 05 15, Portland Cement Concrete.

END OF SECTION 33 05 16

SECTION 33 11 00 WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

Drawings and general provisions of Contract, as well as all the appropriate specification sections of Division 1, apply to work of this section.

1.01 SECTION INCLUDES

A. Pipe and fittings for site water line including domestic water line and sprinkler system meter.

B. Valves

C. Water distribution system: Pipelines and appurtenances which are part of the distribution system outside the building for potable water and fire supply.

D. Water service line: Pipeline from main line to 5 feet outside of building.

1.02 RELATED SECTIONS

A. Section 31 41 33 - Trench Shielding.

B. Section 33 13 00 - Disinfection of Water Distribution Systems

1.03 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI):
1. MSS SP-60-2004 Connecting Flange Joint Between Tapping Sleeves and Tapping Valves
2. MSS SP-108-2002 Resilient-Seated Cast Iron, Eccentric Plug Valves
3. MSS SP-123-1998(R2006) Non-Ferrous Threaded and Solder-Joint Unions for Use With Copper Water Tube
4. American Society of Mechanical Engineers (ASME):
5. A112.1.2-2004 Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water-Connected Receptors))
6. A112.6.3-2001 Floor Drains
7. B16.1-2010 Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250
8. B16.18-2001 Cast Copper Alloy Solder Joint Pressure Fittings
9. B16.22-2001 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
10. B16.24-2006 Cast Copper Alloy Pipe Flanges and Flanged Fittings; Classes 150, 300, 600, 900, 1500 and 2500
11. B31 Code for Pressure Piping Standards

C. American Society for Testing and Materials (ASTM):
1. A36/A36M-08 Carbon Structural Steel
2. A48/A48M-08(2008) Gray Iron Castings
3. A536-84(2009) Ductile Iron Castings
4. A674-10 Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
5. B61-08 Steam or Valve Bronze Castings
6. B62-09 Composition Bronze or Ounce Metal Castings
7. B88/B88M-09 Seamless Copper Water Tube
8. C651-05 Disinfecting Water Mains
9. C858-10e1 Underground Precast Utility Structures
10. D1785-06 Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
11. D2239-03 Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
12. D2464-06 Threaded Poly (Vinyl Chloride) PVC Pipe Fittings, Schedule 80
13. D2466-06 Poly (Vinyl Chloride) (PVC) Pipe Fittings, Schedule 40

14. D2467-06 Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
15. D2609-02(2008) Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
16. D3350-10a Polyethylene Plastics Pipe and Fittings Materials
17. F714-10 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
18. F1267-07 Metal, Expanded, Steel

D. American Water Works Association (AWWA):
1. B300-10 Hypochlorites
2. B301-10 Liquid Chlorine
3. C104-08 Cement–Mortar Lining for Ductile Iron Pipe and Fittings
4. C105/A21.5-10 Polyethylene Encasement for Ductile Iron Pipe Systems
5. C110-08 Ductile Iron and Gray-Iron Fittings
6. C111/A21.11-07 Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings
7. C115/A21.11-11 Flanged Ductile Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges
8. C151/A21.51-09 Ductile Iron Pipe, Centrifugally Cast
9. C153/A21.53-11 Ductile Iron Compact Fittings for Water Service
10. C502-05 Dry-Barrel Fire Hydrants
11. C503-05 Wet-Barrel Fire Hydrants
12. C504-10 Rubber-Seated Butterfly Valves
13. C508-09 Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS
14. C509-09 Resilient-Seated Gate Valves for Water Supply Service
15. C510-07 Double Check Valve Backflow Prevention Assembly
16. C511-07 Reduced-Pressure Principle Backflow Prevention Assembly
17. C512-07 Air Release, Air/Vacuum and Combination Air Valves
18. C550-05 Protective Interior Coatings for Valves and Hydrants
19. C600-10 Installation of Ductile Iron Mains and Their Appurtenances
20. C605-11 Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
21. C606-11 Grooved and Shouldered Joints
22. C651-05 Disinfecting Water Mains
23. C700-09 Cold-Water Meters, “Displacement Type,” Bronze Main Case
24. C800-05 Underground Service Line Valves and Fittings
25. C900-09 Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
26. C906-07 Polyethylene (PE) Pressure Pipe and Fittings, 4 In. (100 mm) Through 64 In. (1,600 mm), for Water Distribution and Transmission
27. C907-04 Injection-Molded PVC Pressure Fittings, 4 Inch through 12 Inch (100 mm through 300 mm), for Water Distribution
28. M23-2nd Ed. PVC Pipe, Design and Installation
29. M44-2nd Ed. Distribution Valves: Selection, Installation, Field Testing and Maintenance

E. National Fire Protection Association (NFPA):
1. NFPA 24-2010 Ed. Installation of Private Fire Service Mains and Their Appurtenances
2. NFPA 1963-2009 Ed. Fire Hose Connections

F. NSF International (NSF):
1. NSF/ANSI 14 (2013) Plastics Piping System Components and Related Materials
2. NSF/ANSI 61-2012 Drinking Water System Components - Health Effects
3. NSF/ANSI 372-2011 Drinking Water System Components – Lead Content

G. American Welding Society (AWS):
1. A5.8/A5.8M-2004 Filler Metals for Brazing and Braze Welding

H. American Society of Safety Engineers (ASSE):
1. 1003-2009 Water Pressure Reducing Valves
2. 1015-2009 Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies
3. 1020-2004 Pressure Vacuum Breaker Assembly
4. 1047-2009 Performance Requirements for Reduced Pressure Detector Fire Protection Backflow Prevention Assemblies
5. 1048-2009 Performance Requirements for Double Check Detector Fire Protection Backflow Prevention Assemblies
6. 1060-2006 Performance Requirements for Outdoor Enclosures for Fluid Conveying Components

I. Underwriters' Laboratories (UL):
1. 246 Hydrants for Fire-Protection Service
2. 262 Gate Valves for Fire-Protection Service
3. 312 Check Valves for Fire-Protection Service
4. 405 Fire Department Connection Devices
5. 753 Alarm Accessories for Automatic Water-Supply Control Valves for Fire Protection Service
6. 789 Indicator Posts for Fire-Protection Service
7. 1091 Butterfly Valves for Fire-Protection Service
8. 1285 Pipe and Couplings, Polyvinyl Chloride (PVC), and Oriented Polyvinyl Chloride (PVCO) for Underground Fire Service

1.04 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of piping mains, valves, connections, and invert elevations in "As-built" utility plan.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with the requirements of the Local Utility Purveyor for fire main work.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place. Ensure that valves are dry and internally protected against rust and corrosion. Protect valves against damage to threaded ends and flange faces.

B. Use a sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

C. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

D. Protect stored piping from moisture and dirt by elevating above grade. Protect flanges, fittings, and specialties from moisture and dirt.

E. Store plastic piping protected from direct sunlight and support to prevent sagging and bending.

F. Cleanliness of Piping and Equipment Systems:

1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.

2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

1.08 Coordination

A. Coordinate connection to water main with Public Utility company.

B. Coordinate water service lines with building contractor.

1.09 Quality Assurance:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least three years. Digital electronic devices, software and systems such as controls, instruments or computer work stations shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years.

C. Regulatory requirements:

1. Comply with the rules and regulations of the public utility company having jurisdiction over the connection to public water lines and the extension and/or modifications to public utility systems.

2. Comply with the rules and regulations of the State and Local authorities having jurisdiction for potable water-service.

3. Comply with rules and regulations of Local authorities having jurisdiction for fire-suppression water-service piping including materials, hose threads, installation and testing.

D. Provide certification of factory hydrostatic testing of not less than 500 psi (3.5 MPa) in accordance with AWWA C151. Piping materials shall bear the label, stamp or other markings of the specified testing agency.

E. Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:

1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".

2. Comply with provisions of ASME B31 series "Code for Pressure Piping".

3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.

4. All welds shall be stamped according to the provisions of the American Welding Society.

F. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Resident Engineer prior to installation.

G. Applicable codes:

1. Plumbing Systems: IPC, International Plumbing Code.

2. Electrical components, devices and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

3. Fire-service main products shall be listed in the FM Global “Approval Guide” or Underwriters Laboratories (UL) “Fire Protection Equipment Directory”.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61 or NSF 372.

B.

C. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended.

2.02 Factory-Assembled Products

A. Standardization of components shall be maximized to reduce spare part requirements. The contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.03 Safety Guards

A. All equipment shall have moving parts protected to prevent personal injury. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gauge sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 1/4 inch (6 mm) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

2.04 Lifting Attachments

A. Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

B.

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2.05 Ductile Iron pipe and fittings

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated, 350 psi (2400 kPa).

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated, 350 psi (2400 kPa).

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

2. Gaskets: AWWA C111, rubber.

C. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, round-grooved ends.

1. Grooved-End, Ductile-Iron Pipe Appurtenances: ASTM A47, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions matching pipe, 350 psi (3400 kPa).

2. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions, Include ferrous housing sections, gasket suitable for water, and bolts and nuts.

3. Gaskets: AWWA C111.

D. Flanged Ductile Iron Pipe: AWWA C115/A21.11, with factory applied screwed long hub flanges.

1. Flanges: ASME B16.1 for // 125 psi (850 kPa) // or // 250 psi (1725 kPa) // pressure ratings, as necessary.

2. Wall Sleeve Castings, size and types shown on the drawings, shall be hot dipped galvanized per ASTM A123.

3. Pipe and fittings exposed to view in the finished work are to be painted in accordance with Section 09 91 00, PAINTING. Pipe shall be shop primed with one coat of rust inhibitive primer. Final paint color shall match the final wall color.

E. Cement Mortar Internal Lining: Cement mortar lining and bituminous seal coat as per AWWA C104.

F. Exterior Pipe Coating: The exterior of pipe shall have the standard asphaltic coating.

2.06 Polyvinyl Chloride pipe and fittings

A. PVC, Schedule 40 Pipe: ASTM D1785.

1. PVC, Schedule 40 Socket Fittings: ASTM D2466.

B. PVC, Schedule 80 Pipe: ASTM D1785.

1. PVC, Schedule 80 Socket Fittings: ASTM D2467.

2. PVC, Schedule 80 Threaded Fittings: ASTM D2464.

C. PVC, AWWA Pipe: AWWA C900, // Class 150 // and // Class 200 // , with bell end with gasket, and with spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.

2. PVC Fabricated Fittings: AWWA C900, // Class 150 // and // Class 200 // , with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

4. Push-on-Joint, Ductile-Iron Fittings: // AWWA C110, ductile- or gray-iron standard pattern // or // AWWA C153, ductile-iron compact pattern//.

5. Gaskets: AWWA C111, rubber.

6. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

7. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.07 PE pipe and fittings

A. PE, ASTM Pipe: ASTM D2239, SIDR No. 5.3, 7, or 9; with PE compound number required to give pressure rating not less than // 160 psi (1100 kPa) // 200 psi (1380 kPa) //.

1. Insert Fittings for PE Pipe: ASTM D2609, made of PA, PP, or PVC with serrated male insert ends matching inside of pipe. Include bands or crimp rings.

2. Molded PE Fittings: ASTM D3350, PE resin, socket- or butt-fusion type, made to match PE pipe dimensions and class.

B. PE, AWWA Pipe: AWWA C906, DR No. 7.3, 9, or 9.3; with PE compound number required to give pressure rating not less than // 160 psi (1100 kPa) // 200 psi (1380 kPa) //.

1. PE, AWWA Fittings: AWWA C906, socket- or butt-fusion type, with DR number matching pipe and PE compound number required to give pressure rating not less than // 160 psi (1100 kPa) // 200 psi (1380 kPa) //.

C. PE, Fire-Service Pipe: ASTM F714, AWWA C906, or equivalent for PE water pipe; FMG approved, with minimum thickness equivalent to FMG // Class 150 // and // Class 200 //.

1. Molded PE Fittings: ASTM D3350, PE resin, socket-or butt-fusion type, made to match PE pipe dimensions and class.

2.08 Copper tube and fittings

A. Soft Copper Tubing: // ASTM B88, Type K // ASTM B88, Type A // and // ASTM B88, Type L // ASTM B88, Type B // water tube, annealed temper.

B. Hard Copper Tubing: // ASTM B88, Type K // ASTM B88, Type A// and // ASTM B88, Type L // ASTM B88, Type B // water tube, drawn temper.

C. Fittings: // ASME B16.18, cast copper alloy // or // ASME B16.22, wrought copper alloy //, solder joint pressure fittings.

D. Brazing Alloy: AWS A5.8/A5.8M, Classification BCuP.

E. Bronze Flanges: // ASME B16.24, Class 150, with solder joint ends. // ASME B16.24, Class 300 flanges if required to match piping. //

F. Copper Unions: ANSI MSS SP-123, cast copper alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

2.09 Valves

A. Gate Valves: AWWA C509, Non-rising Stem, Resilient Seat, 200 psi (1380 kPa).

1. Valves 3 inches (75 mm) and larger: Resilient seat valve with gray- or ductile iron body and bonnet; cast iron or bronze double-disc gate; bronze gate rings; non-rising bronze stem and stem nut.

2. Interior and exterior coating: AWWA C550, thermo-setting or fusion epoxy.

3. Underground valve nut: Furnish valves with 2 inch (50 mm) nut for socket wrench operation.

4. Aboveground and pit operation: Furnish valves with hand wheels.

5. End connections shall // be mechanical joint // be push on // match main line pipe //.

B. Gate Valve Accessories and Specialties

1. Tapping-Sleeve Assembly: ANSI MSS SP-60; sleeve and valve to be compatible with the drilling matching.

a. Tapping Sleeve: // Cast // or // Ductile Iron // or // Stainless-Steel //, two-piece bolted sleeve. Sleeve to match the size and type of pipe material being tapped.

b. Valve shall include one raised face flange mating tapping-sleeve flange.

2. Valve Boxes: AWWA M44 with top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel.

3. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut. (Provide two wrenches for Project.)

4. Indicator Posts: UL 789, FMG approved, vertical-type, cast iron body with operating wrench, extension rod, and adjustable cast iron barrel of length required for depth of burial of valve.

C. Swing Check Valves:

1. Valves smaller than 2 inches (25 mm): ASTM B61, resilient seat, bronze body and bonnet, pressure rating of 200 psi (1380 kPa). Ends to match main line piping.

2. Valves 2 inches (25 mm) or larger: AWWA 508, resilient seat valve with iron body and bonnet, pressure rating of 200 psi (1380 kPa).

3. Coating: AWWA C550, fusion epoxy coated.

D. Detector Check Valves

1. Iron body, corrosion-resistant clapper ring and seat ring material, flanged ends, with connections for bypass and installation of water meter.

a. Standards: UL 312 and FMG approved, 175 psi (1207 kPa).

E. Butterfly Valves

1. Rubber-Seated Butterfly Valve: AWWA C504

a. Provide rubber seated butterfly valve // cast // or // ductile iron body // , // wafer // wafer or flanged // flanged //, minimum pressure of 150 psi (1035 kPa).

2. UL Butterfly Valve: UL 1091 and FMG approved.

a. Provide metal on resilient material seating butterfly valves that are UL 1091 and FMG approved, // cast // or // ductile iron body // , // wafer // wafer or flanged // flanged // minimum pressure of 175 psi (1207 kPa).

F. Plug Valves: ANSI MSS SP-108, resilient-seated eccentric plug valve, minimum pressure of 175 psi (1207 kPa).

G. Corporation Valves and Curb Valves

1. Service-Saddle Assemblies: AWWA C800.

a. Service Saddle: Copper alloy with seal and threaded outlet for corporation valve.

b. Corporation Valve: Bronze body and ground-key plug, with threaded inlet and outlet matching service piping material.

c. Manifold: Copper fitting with two to four inlets as required, with ends matching corporation valves and outlet matching service piping material.

2. Curb Valves: AWWA C800, bronze body, ground-key plug or ball, wide tee head, with inlet and outlet matching service piping material, minimum pressure of 200 psi (1375 kPa).

3. Service Boxes for Curb Valves: AWWA M44, cast iron telescoping top section; plug shall include lettering "WATER"; bottom section with base that fits over curb valve.

4. Shutoff Rods: Steel, tee-handle with one pointed end. Stem length shall extend 2 feet (600 mm) above top of valve box for operation of deepest buried valve, with slotted end matching curb valve.

H. Post-Indicator: NFPA 24 and be fully compatible with the valve and supervisory switches.

I. Water Meter: SECTION 25 10 10, ADVANCED UTILITY METERING SYSTEM.

1. Water Meter will be furnished and set by Water Service Utility

2. Water Meter will be furnished by Water Service Utility and installed by Contractor

3. Furnish and install meter approved by the Water Service Utility. Forward approval of meter to VA Contracting Officer Representative

J. Pressure Reducing Valves

1. Pressure reducing valve: ASSE 1003 with pressure of 150 psi (1035 kPa).

a. Size: // Insert NPS (DN) //
b. Design flow rate: // Insert gpm (L/s) //

c. Design inlet pressure: // Insert psi (kPa) //

d. Design outlet pressure setting: // Insert psi (kPa) //

2. Body: Bronze // with chrome-plated finish // for NPS 2 (DN 50) and smaller

3. Body: Cast iron // with interior lining complying with AWWA C550 or other that is FDA approved // for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

4. End connections: Threaded for NPS 2 (DN 50) and smaller.

5. End connections: Flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80)

K. Water Control Valves

1. Valve to be pilot operation, diaphragm-type, single-seated, pressure rating should be 150 psi (1035 kPa) minimum. Include small pilot control valve, restrictor device, specialty fittings and sensor piping.

a. Size: // Insert NPS (DN) //

b. Pattern: // Angle // Glove // -valve design

c. Trim: Stainless steel

d. Design flow rate: // Insert gpm (L/s) //

e. Design inlet pressure: // Insert psi (kPa) //

f. Design outlet pressure setting: // Insert psi (kPa)

2. Body shall be // cast // or // ductile iron // with AWWA C550 epoxy coating // or // stainless steel //.

3. End connections: Threaded for NPS 2 (DN 50) and smaller.

4. End connections: Flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

5. Interior coating: AWWA C550.

L. Relief Valves

1. Air-Release Valve: AWWA C512, Hydromechanical device to automatically release accumulated air.

2. Air/Vacuum Valve: AWWA C512, Direct-acting, float-operated, hydromechanical device with large orifice to automatically release accumulated air or to admit air during filling of piping.

3. Combination Air Valve: AWWA C512, Float-operated, hydromechanical device to automatically release accumulated air or to admit air during filling of piping.

   a. Pressure Rating: // 300 psi (2070 kPa)

   b. Body material: // Cast iron // Insert material

   c. Trim material: // Stainless steel // brass// or // bronze

   d. Water inlet size: // Insert NPS (DN) //

   e. Air outlet size: // Insert NPS (DN) //

   f. Orifice size: // Insert inch (mm) //

   g. Design air-release capacity: // Insert cfm (L/s) // at // Insert psi (kPa) //

M. Pressure Vacuum Breaker Assembly

1. ASSE 1020 Vacuum breaker assembly for use in continuous-pressure applications.

2. Pressure loss: // 12 psi (83 kPa) // maximum, through middle 1/3 of flow range.

3. Size: // Insert NPS (DN) //

4. Design flow rate: // Insert gpm (L/s) //

5. Selected unit flow range limits: // Insert gpm (L/s) //

6. Pressure loss at design flow rate: // Insert psi (kPa) //

7. Accessories: Ball valves on inlet and outlet.

N. Backflow Preventer

1. Backflow Preventer shall not be located in any area containing fumes that are toxic, poisonous or corrosive.

2. Direct connections between potable water piping and sewer connected wastes shall not exist under any condition with or without backflow protection.

3. Backflow Preventer shall be accessed and have clearances for the required testing, maintenance and repair. Access and clearances shall maintain a minimum of 1 foot (305 mm) between the lowest portion of the assembly and grace, floor or platform. Installations elevated more than 5 feet (1524 mm) above the floor or grade shall be provided with a permanent platform capable of supporting a tester or maintenance person.

O. Reduced-Pressure-Principle Backflow Preventer: AWWA C511 for continuous-pressure applications.

1. Pressure loss: 15 psi (100 kPa) maximum, through middle 1/3 of flow range.

2. Size: // Insert NPS (DN) //

3. Design flow rate: // Insert gpm (L/s) //

4. Selected unit flow range limits: // Insert gpm (L/s) //

5. Pressure loss at design flow rate: // Insert psi (kPa) // for NPS 2 (DN 50) and smaller; // Insert psi (kPa) // for NPS 2-1/2 (DN 65) and larger.

6. Body:

   a. Bronze: NPS 2 (DN 50) and smaller, // cast iron with interior lining complying with AWWA C550 /

   b. Steel with interior lining complying with AWWA C550 // stainless steel // for NPS 2-1/2 (DN 65) or larger.

7. End connections:

   a. Threaded for NPS 2 (DN 50) and smaller.

   b. // Flanged // Insert type // for NPS 2-1/2 (DN 65) and larger.

8. Configuration: Designed for // horizontal, straight through // vertical inlet, horizontal center section and vertical outlet // vertical // Insert configuration // flow.

9. Valves:

   a. Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller.

   b. Resilient seated gate type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

10. Air-gap fitting: ASME A112.1.2, matching backflow Preventer connection.

P. Double-Check, Backflow-Prevention Assemblies: // ASSE 1015 // or // AWWA C510 // for continuous-pressure applications, unless otherwise indicated.

1. Pressure loss: // 5 psi (35 kPa) // Insert pressure // maximum, through middle 1/3 of flow range.

2. Size: // Insert NPS (DN) //

3. Design flow rate: // Insert gpm (L/s) //

4. Selected unit flow range limits: // Insert gpm (L/s) //

5. Pressure loss at design flow rate:

   a. // Inset psi (kPa) // for NPS 2 (DN 50) and smaller.

   b. // Inset psi (kPa) // for NPS 2-1/2 (DN 65) and larger.

6. Body:

   a. Bronze for NPS 2 (DN 50) and smaller.

   b. // Cast iron with interior lining complying with AWWA C550 // Steel with interior lining complying with AWWA C550 // Stainless steel // for NPS 2-1/2 (DN 65) or larger.

7. End connections:

    a. Threaded for DN 50 (NPS 2) and smaller.

    b. // Flanged // Insert type // for NPS 2-1/2 (DN 65) and larger.

8. Configuration: Designed for // horizontal, straight through // vertical inlet, horizontal center section and vertical outlet // vertical // Insert configuration // flow.

9. Valves:

    a. Ball type with threaded ends on inlet and outlet of NPS 2 (DN 50) and smaller.

    b. OS&Y gate type with flanged ends on inlet and outlet of NPS 2-1/2 (DN 65) and larger.

Q. Reduced-Pressure-Detector, Fire-Protection Backflow Preventer Assemblies: ASSE 1047 and UL listed or FMG approved for continuous-pressure applications.

1. Pressure loss: // 12 psi (83 kPa) // Insert pressure // maximum, through middle 1/3 of flow range

2. Size: // Insert NPS (DN)//

3. Design flow rate: // Insert gpm (L/s)//

4. Selected unit flow range limits: // Insert gpm (L/s)//

5. Pressure loss at design flow rate: // Inset psi (kPa)//

6. Body: // Cast iron with interior lining complying with AWWA C550 // Steel with interior lining complying with AWWA C550 // Stainless steel //

7. End connections: Flanged

8. Configuration: Designed for // horizontal, straight through // vertical inlet, horizontal center section and vertical outlet // vertical // Insert configuration // flow.

9. Accessories:

    a. Valves: UL 262, FMG approved, OS&Y gate type with flanged ends on inlet and outlet.

    b. Air-gap fitting: ASME A112.1.2, matching backflow Preventer connection.

    c. Bypass with displacement-type water meter, shutoff valves and reduced-pressure backflow Preventer.

R. Double-Check, Detector-Assembly Backflow Preventers: ASSE 1048 and UL listed or FMG approved for continuous-pressure applications.

1. Pressure loss: // 5 psi (35 kPa) // Insert pressure // maximum, through middle 1/3 of flow range

2. Size: // Insert NPS (DN) //

3. Design flow rate: // Insert gpm (L/s) //

4. Selected unit flow range limits: // Insert gpm (L/s) //

5. Pressure loss at design flow rate: // Inset psi (kPa) //

6. Body: // Cast iron with interior lining complying with AWWA C550 // Steel with interior lining complying with AWWA C550 // Stainless steel //

7. End connections: Flanged

8. Configuration: Designed for // horizontal, straight through // vertical inlet, horizontal center section and vertical outlet // vertical // Insert configuration // flow

9. Accessories

a. Valves: UL 262, FMG approved, OS&Y gate type with flanged ends on inlet and outlet.

b. Bypass with displacement-type water meter, shutoff valves and reduced-pressure Backflow Preventer.

S. Backflow Preventer Test Kits

1. Provide factory calibrated test kit with gauges, fittings, hoses and carrying case with test-procedure instructions.

2.10 Water Meter Boxes

A. Cast iron body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping.

1. Base section may be cast iron, PVC, PE, or other pipe.

B. Cast iron body and double cover for disc-type water meter, with lettering "WATER METER" in top cover; and with separate inner cover; air space between covers; and slotted, open-bottom base section of length to fit over service piping.

C. Polymer-concrete body and cover for disc-type water meter, with lettering "WATER METER" in cover; and with slotted, open-bottom base section of length to fit over service piping, vertical and lateral design loadings of 15,000 lb minimum over 10 by 10 inches (6800 kg minimum over 254 mm by 254 mm) square.

2.11 Concrete Vaults

A. Precast, reinforced-concrete vault: ASTM C858, designed for AASHTO H20-44 load designation.

1. Ladder: ASTM A36, steel or polyethylene-encased steel steps.

2. Drain: ASME A112.6.3, cast iron floor drain with outlet. Include body anchor flange, light-duty cast iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

3. Manhole Frame and Cover: ASTM A48, Class No. 35A minimum tensile strength, 24 inch (610 mm) minimum diameter, unless otherwise indicated.

4. Manhole Frame and Cover: ASTM A536, Grade 60-40-18, ductile iron, 24 inch (610 mm) minimum diameter, unless otherwise indicated.

2.12 Protective Enclosures

A. Freeze-Protection Enclosures: Designed to protect aboveground water piping, equipment, or specialties from freezing and damage, with heat source to maintain minimum internal temperature of 40 deg F (4 deg C) when external temperatures reach as low as minus 34 deg F (minus 36 deg C) meeting the requirements of ASSE 1060.

1. Class I, for equipment or devices other than pressure or atmospheric vacuum breakers.

2. Class I-V, for pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

3. Reinforced //-aluminum// or // -fiberglass // Insert // housing with dimensions indicated, but not less than those required for access and service of protected unit. Include a drain opening for units with drain connection; access doors with locking devices; insulation inside housing; and anchoring devices for attaching the housing to the concrete base.

4. Include an electric heating cable or heater with self-limiting temperature control.

B. Weather-Resistant Enclosures: Un-insulated enclosure designed to protect aboveground water piping, equipment, or specialties from weather and damage meeting the requirements of ASSE 1060.

1. Class III, for equipment or devices other than pressure or atmospheric vacuum breakers.

2. Class III-V, for pressure or atmospheric vacuum breaker equipment or devices. Include drain opening in housing.

3. Provide reinforced // -aluminum // or // -fiberglass // Insert // housing with dimensions indicated, but not less than those required for access and service of protected unit. Include a drain opening for units with drain connection; access doors with locking devices; insulation inside housing; and anchoring devices for attaching the housing to the concrete base

C. Expanded-Metal Enclosures: ASTM F1267; designed to protect aboveground water piping, equipment, or specialties from damage; expanded metal side and top panels, of weight and with reinforcement of same metal at edges as required for rigidity.

1. Type // I, expanded // II, expanded and flattened //.

2. Class // 1, uncoated carbon steel // 2, hot-dip, zinc-coated carbon steel // 3, corrosion-resisting steel //.

3. Provide a finish of the manufacturer's enamel paint. Size enclosure to match the dimensions indicated, but not less than those required for access and service of the protected unit. Include a locking device and lugs or devices necessary for securing enclosure to base.

D. Enclosure Bases: // 4 inch (100 mm) // 6 inch (150 mm) // minimum thickness precast concrete, extending at least 6 inches (150 mm) beyond edges of enclosure housings. Include openings for piping.

2.13 Flushing Hydrants

A. Post-Type Flushing Hydrants: Non-freeze and drainable, of length required for shutoff valve installation below frost line.

1. Pressure Rating: 150 psi (1035 kPa) minimum

2. Outlet: One, with horizontal discharge

3. Hose Thread: // NPS 2-1/2 (DN 65) // Insert NPS (Insert DN) // , with NFPA 1963 external hose thread for use by local fire department, and with cast iron cap with brass chain

4. Barrel: // Cast iron // or // steel pipe // with breakaway feature

5. Valve: Bronze body with // bronze-ball // or // plunger closure // , and automatic draining

6. Security: Locking device for padlock

7. Exterior Finish: Red alkyd-gloss enamel paint.

8. Inlet: NPS 2 (DN 50) minimum

9. Operating Wrench: One for each unit

B. Ground-Type Flushing Hydrants: Non-freeze and drainable, of length required for shutoff valve installation a

2.14 PIPE

A. Pipe shall be AWWA C100, Class 350 Ductile Iron Pipe:

1. Fittings: Ductile iron, standard thickness.

2. Joints: ANSI/AWWA C111, rubber gasket with rods.

B. AWWA C900, DR-14 PVC Pipe:

1. Fittings: Ductile iron, standard thickness.

2. Joints: ANSI/AWWA C111, rubber gasket with rods.

2.15 GATE VALVES - Up to 3 Inches (75 mm):

A. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, with control rod, extension box and valve key.

2.16 GATE VALVES - 3 Inches (75 mm) and Over

A. ANSI/AWWA C509, Iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, control rod, extension box and valve key.

2.17 HYDRANT

A. Hydrants for the project shall meet the Local Jurisdiction requirements.

B. Contractor shall contact the Local Jurisdiction (City or County) Fire Marshall to verify hose and steamer connection diameters and threads. Match sizes with Local Jurisdiction Fire Department, two hose nozzles, one pumper nozzle.

C. Hydrant Extensions: Fabricate in multiples of 6 inches with rod and coupling to increase barrel length.

D. Finish: Primer and two coats of enamel to color required by the Local Jurisdiction or Fire Department.

2.18 BEDDING MATERIALS

A. Bedding: Crushed stone with not less than 95% passing the 3/4" sieve and not less than 95% retained by the No. 4 sieve.

2.19 ACCESSORIES

A. Concrete for Thrust Blocks: Concrete shall be min. 3000 psi specified in Section 033000.

B. Joint Restraint: All joints shall have meg-a-lug joint restraint..

C. Detectable Underground Utility Marking Tape shall be equal to Pro-Line Safety Products Co.'s consisting of a minimum 5 mil overall thickness with a solid aluminum foil core with reverse printing laminated to aluminum foil by use of a min 2 mil clear film. Detectable Underground Marking tape shall meet the American Public Works Association's color code (blue).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location and invert are as indicated.

3.02 PREPARATION

A. Ream pipe and tube ends and remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 BEDDING

A. Excavate pipe trench in accordance with Section 31 41 33 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, compact to 95 percent.

C. Backfill around sides and to top of pipe with fill, tamped in place and compacted to 95 percent.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.04 INSTALLATION - PIPE

A. Maintain a minimum of 9' outside of pipe to outside of pipe separation of fire lead from sanitary sewer. At all locations where fire lead and sewer lines cross, place fire lead main above sanitary sewer line and encase water line with 12 concrete encasement 10' on each side of sanitary sewer line.

B. Route pipe in straight line.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints.

D. Install access fittings to permit disinfection of water system performed under Section 33 13 00.

E. Slope water pipe and position drain at low points.

F. Form and place concrete for thrust blocks at each elbow or change of direction of pipe main.

G. Establish elevations of buried piping to ensure not less than 18" of cover.

H. Backfill trench in lifts not exceeding 8" compacted thickness.

I. Piping valves and fire hydrant shall be installed within the dedicated easement (if any).

3.05 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Set hydrants plumb and locate pumper nozzle perpendicular to roadway.

D. Set hydrants to grade, with nozzles at least 20 inches above ground.

E. Locate control valve 4 feet away from hydrant.

F. Provide a drainage pit as shown on the drawings. Encase elbow of hydrant in gravel to point 1 inch below drain opening. Do not connect drain opening to sewer.

3.06 DISINFECTION OF WATER PIPING SYSTEM

A. Flush and disinfect system in accordance with Section 33 13 00.

3.07 FIELD QUALITY CONTROL

A. Field inspection and pressure testing will be performed by Contractor.

B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.08 REGULATORY REQUIREMENTS

A. Provide certificate of compliance from the corresponding City Authority indicating approval of fire service main system.

END OF SECTION 33 11 00

SECTION 33 11 00.17 - POLYETHYLENE WRAP

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. The minimum requirements for polyethylene wrap to be used for external corrosion protection of buried ductile iron pipe, fittings, and appurtenances and for cast iron and ductile iron fittings on PVC pipe, and for barrier valves.

1.02 SUBMITTALS

A. Conform to requirements of Section 01 33 00 - Submittals.

B. Submit product data for proposed film and tape for approval.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Polyethylene Film: Tubular or sheet form without tears, breaks, holidays, or defects; conforming with requirements of AWWA C105, 2.5 to 3 percent carbon black content, either low or high density:

B. Low-density polyethylene film shall be manufactured from virgin polyethylene material conforming to the following requirements of ASTM D4976.

1. Raw material.

   a. Group: 2 (linear)

   b. Class: C (black).

   c. Density: 0.910 to 0.935 g/cm^3

   d. Dielectric strength: Volume resistivity, 1015 ohm-cm, minimum

2. Physical properties.

   a. Tensile strength: 3600 psi, minimum.

   b. Elongation: 800 percent, minimum.

   c. Dielectric strength: 800 V/mil thickness, minimum.

3. Thickness: Low-density polyethylene film shall have normal thickness of 0.008 inch. Minus tolerance on thickness is 10 percent of nominal thickness

C. High-density, cross laminated polyethylene film shall be manufactured from virgin polyethylene material conforming to the following requirements of ASTM D4976.

1. a. Raw material.

   a. Group: 2 (linear)

   b. Density: 0.940 to 0.960 g/cm^3

      Class: C (black)

c. Dielectric strength: Volume resistivity, 1015 ohm-cm, minimum.

2. b. Physical properties.

a. Tensile strength: 6300 psi, minimum.

b. Elongation: 100 percent, minimum.

c. Dielectric strength: 800 V/mil thickness, minimum.

3. Thickness: Film shall have nominal thickness of 0.004 inch. Minus tolerance of thickness is 10 percent of nominal thickness.

D. Polyethylene Tape: Provide minimum 2-inch-wide (3-inch typical), plastic-backed, adhesive tape.

PART 3 - EXECUTION

3.01 PREPARATION

A. Remove lumps of clay, mud, and cinders from pipe surface prior to installation of polyethylene encasement. Prevent soil or embedment material from becoming trapped between pipe and polyethylene.

B. Fit polyethylene film to contour of pipe to affect snug, but not tight fit; encase with minimum space between polyethylene and pipe. Allow sufficient slack in contouring to prevent stretching polyethylene where it bridges irregular surfaces, such as bell-spigot interfaces, bolted joints, or fittings, and to prevent damage to polyethylene due to backfilling operations. Secure overlaps and ends with adhesive tape to hold polyethylene encasement in place until backfilling operations are complete.

C. For installations below water table or in areas subject to tidal actions, seal both ends of polyethylene tube with adhesive tape at joint overlap

3.02 INSTALLATION

A. Tubular Type (Method A):

1. Cut polyethylene tube to length approximately 2 feet longer than pipe section. Slip tube around pipe, centering tube to provide 1-foot overlap on each adjacent pipe section, and bunching it accordion-fashion lengthwise until it clears pipe ends.

2. Lower pipe into trench and make up pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene tube.

3. After assembling pipe joint, make overlap of polyethylene tube. Pull bunched polyethylene from preceding length of pipe, slip it over end of adjoining length of pipe, and secure in place. Then slip end of polyethylene from adjoining pipe section over end of first wrap until it overlaps joint at end of preceding length of pipe. Secure overlap in place. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points.

4. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

B. Tubular Type (Method B):

1. Cut polyethylene tube to length approximately 1 foot shorter than pipe section. Slip tube around pipe, centering it to provide 6 inches of bare pipe at each end. Take up slack width at top of pipe to make snug, but not tight, fit along barrel of pipe, securing fold at quarter points; secure ends.

2. Before making up joint, slip 3 foot length of polyethylene tube over end of preceding pipe section, bunching in accordion-fashion lengthwise. After completing joint, pull 3 foot length of polyethylene over joint, overlapping polyethylene previously placed on each adjacent section of pipe by at least I foot; make each end snug and secure.

3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

C. Sheet Type:

1. Cut polyethylene sheet to length approximately 2 feet longer than pipe section. Center length to provide 1-foot overlap on each adjacent pipe section, bunching sheet until it clears pipe ends. Wrap polyethylene around pipe so that sheet circumferentially overlaps top quadrant of pipe. Secure cut edge of polyethylene sheet at intervals of approximately 3 feet.

2. Lower wrapped pipe into trench and makeup pipe joint with preceding section of pipe. Make shallow bell hole at joints to facilitate installation of polyethylene. After completing joint, make overlap and secure ends.
3. Repair cuts, tears, punctures, or other damage to polyethylene. Proceed with installation of next section of pipe in same manner.

D. Pipe-shaped Appurtenances: Cover bends, reducers, offsets, and other pipe-shaped appurtenances with polyethylene in same manner as pipe.

E. Odd-shaped Appurtenances: When it is not practical to wrap valves, tees, crosses, and other odd-shaped pieces in tube, wrap with flat sheet or split length of polyethylene tube by passing sheet around appurtenance and encasing it. Make seams by bringing edges together, folding over twice, and taping down. Tape polyethylene securely in place at valve stem and other penetrations.

F. Openings in Encasement: Create openings for branches, service taps, blow-offs, air valves, and similar appurtenances by making X-shaped cut in polyethylene and temporarily folding back film. After appurtenance is installed, tape slack securely to appurtenance and repair cut, as well as other damaged area in polyethylene, with tape. Service taps may also be made directly through polyethylene, with resulting damaged areas being repaired as specified.

G. Junctions between Wrapped and Unwrapped Pipe: Where polyethylene-wrapped pipe joins adjacent pipe that is not wrapped, extend polyethylene wrap to cover adjacent pipe for distance of at least 3 feet. Secure end with circumferential turns of tape. Wrap service lines of dissimilar metals with polyethylene or suitable dielectric tape for minimum clear distance of 3 feet away from cast or ductile iron pipe.

3.03 REPAIRS

A. A. Repair cuts, tears, punctures, or damage to polyethylene with adhesive tape or with short length of polyethylene sheet or cut open tube, wrapped around pipe to cover damaged area, and secured in place.

END OF SECTION 33 11 00.17

SECTION 33 13 00 DISINFECTION OF WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

Drawings and general provisions of Contract, as well as all the appropriate specification sections of Division 1, apply to work of this section.

1.01 SECTION INCLUDES

A. Disinfection of potable water distribution and fire service system.

B. Testing and reporting results.

1.02 RELATED SECTIONS

A. Section 33 11 00 – Water Utility Distribution Piping.

1.03 SUBMITTALS

A. Test Reports: Indicate results comparative to specified requirements. Test reports shall be submitted to owner and engineer.

B. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements. Certificates shall be submitted to the owner and engineer.

1.04 PROJECT RECORD DOCUMENTS

A. Disinfection report; record:

1. Type and form of disinfectant used.
2. Date and time of disinfectant injection start and time of completion.
3. Test locations.
4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
5. Date and time of flushing start and completion.
6. Disinfectant residual after flushing in ppm for each outlet tested.

B. Bacteriological report; record:

1. Date issued, project name, and testing laboratory name, address, and telephone number.
2. Time and date of water sample collection.
3. Name of person collecting samples.
4. Test locations.
5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
6. Coliform bacteria test results for each outlet tested.

7. Certification that water conforms, or fails to conform, to bacterial standards of the local water purveyor or local jurisdiction.

8. Bacteriologist's signature and authority.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with ANSI/AWWA C651.

1.06 QUALIFICATIONS

A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum three years documented experience.

B. Testing Firm: Company specializing in testing or examining potable water systems, certified and approved by the State of Texas.

1.07 REGULATORY REQUIREMENTS

A. Provide certificate of compliance from local jurisdiction indicating approval of water system.

PART 2 - PRODUCTS

2.01 DISINFECTION CHEMICALS

A. Chemicals: ANSI/AWWA B300, Hypochlorite, ANSI/AWWA B301, Liquid Chlorine, ANSI/AWWA B302, Ammonium Sulfate, and ANSI/AWWA B303, Sodium Chlorite.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping system has been cleaned, inspected, and pressure tested.

B. Perform scheduling and disinfection activity with start-up, testing, adjusting and balancing, demonstration procedures, including coordination with related systems.

3.02 EXECUTION

A. Provide and attach required equipment to perform the work of this Section.

B. Introduce treatment disinfectant into piping system.

C. Maintain disinfectant in system for 24 hours.

D. Flush, circulate and clean until required cleanliness is achieved; use municipal domestic water.

E. Replace permanent system devices removed for disinfection.

F. Pressure test system to 100 psi. Repair leaks and re-test.

3.03 QUALITY CONTROL

A. Provide analysis and testing of treated water to owner and engineer.

B. Test samples in accordance with ANSI/AWWA C651.

END OF SECTION 33 13 00

SECTION 33 31 00 SANITARY UTILITY SEWERAGE PIPING

PART 1 - GENERAL

Drawings and general provisions of Contract, as well as all the appropriate specification sections of Division 1, apply to work of this section.

1.01 SECTION INCLUDES

A. Sanitary sewerage drainage piping, fittings, accessories and bedding.

B. Connection of building sanitary drainage system to municipal sewers.

C. Cleanout access.

1.02 RELATED SECTIONS

A. Section 31 41 33 – Trench Shielding.

B. Section 33 41 00 – Storm Utility Drainage Piping.

C. Section 03 30 00 - Cast-in-Place Concrete: Concrete type for cleanout base pad construction.

1.03 REFERENCES

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. ANSI/ASTM A74 - Cast Iron Soil Pipe and Fittings.

C. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.

D. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

E. ASTM D-1785 - PVC Schedule 40 Sewer Pipe and Fittings.

F. ASTM D-3033/3034 - PVC Schedule 40 Drain-Waste-Vent Fittings.

G. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.04 SUBMITTALS

A. Product Data: Provide data indicating pipe, fittings, and pipe accessories.

B. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.05 PROJECT RECORD DOCUMENTS

A. Record location of pipe runs, connections, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 REGULATORY REQUIREMENTS

A. Work shall conform to the Local Jurisdiction and the Uniform Plumbing Code and or International Plumbing Code requirements whichever has been accepted by the local jurisdiction as well as the local jurisdictions amendments to the accepted code.

1.07 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated in the drawings.

1.08 COORDINATION

A. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service and trenching.

PART 2 - PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Plastic Pipe: ASTM D-3034, Maximum SDR-26 PVC material; inside nominal diameter of 4 to 8 inches Bell and spigot only.

B. All pipes require the Bell and spigot pipe with gasketed joints.

2.02 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

B. Fittings: ASTM D-3033/3034 PVC gasketed sewer fittings, formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

C. Detectable Underground Utility Marking Tape shall be equal to Pro-Line Safety Products Co.'s consisting of a minimum 5 mil overall thickness with a solid aluminum foil core with reverse printing laminated to aluminum foil by use of a min 2 mil clear film. Detectable Underground Marking tape shall meet the American Public Works Association's color code (green).

2.03 CLEANOUTS

A. At 50' intervals and/or where shown on the drawings. (not required between manholes)

2.04 BEDDING MATERIALS

A. Bedding: Crushed stone with not less than 95% passing the 3/4" sieve and not less than 95% retained by the No. 4 sieve.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate or lean concrete.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

3.03 BEDDING

A. Excavate pipe trench in accordance with Section 31 41 33 for work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, compact to 95 percent.

C. Backfill around sides and to top of pipe with fill, tamped in place and compacted to 95 percent.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.04 INSTALLATION - PIPE

A. Maintain a minimum of 9' outside of pipe to outside of pipe separation of water main from sanitary sewer. At all locations where water and sewer lines cross, place water main above sanitary sewer line and encase water line with 12 concrete encasement 10' on each side of sanitary sewer line.

B. Route pipe in straight line.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints.

D. Seal joints watertight.

E. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

F. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches compacted to 95 percent.

G. Do not displace or damage pipe when compacting.

H. Coordinate with onsite sewage facility installer for location and elevations of drainfields.

3.05 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

3.06 FIELD QUALITY CONTROL

A. Request inspection prior to and immediately after placing bedding.

B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

D. Infiltration Test: Test in accordance with Section 33 01 30 Testing of Gravity Sewer Systems and the Uniform Plumbing Code requirements.

E. Deflection Test: Test in accordance with Section 33 01 30 Testing of Gravity Sewer Systems and the Uniform Plumbing Code requirements.

3.07 PROTECTION

A. Protect finished installation.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.08 SCHEDULE

A. Sanitary Sewer Main: see drawings for each project site.

B. Cleanouts: Spaced not more than 50' along each wastewater line. (Not required between manholes)

3.09 GENERAL BACKFILLING

A. Backfill shall be as shown on the plans. Place in 6-inch maximum loose lifts to one foot above pipe unless otherwise specified. Bring up evenly on each side, and for the full length of the structure. Ensure that no damage is done to structures or protective coatings thereon. Place the remainder of the backfill in 8-inch maximum loose lifts unless otherwise specified. Compact each loose lift as specified in Paragraph "General Compaction" before placing the next lift. Where unacceptable settlements occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation.

B. No backfill shall be placed until the line has been inspected and approved for backfilling.

3.10 GENERAL COMPACTION

A. Use hand-operated plate type vibratory or other suitable hand tampers in areas not accessible to larger rollers or compactors. Be careful to avoid damaging pipes and protective pipe coatings. Compaction shall be in accordance with the following unless otherwise specified. If necessary, the Contractor's selected equipment and construction procedure shall be altered, changed or modified in order to meet the specified compaction requirements.

B. Initial backfill and bedding shall be carefully packed under the haunches of the pipe and brought up simultaneously on both sides so as to obviate any displacement of the pipe from its true alignment. Bedding shall be compacted in layers not more than eight (8) inches in thickness in a manner that will preclude moving the pipe, to not less than 95% of maximum dry density as determined by the procedure set forth in ASTM Designation D1557. Jetting of backfill material will not be permitted.

C. Select backfill above the initial backfill shall be placed in loose lifts not exceeding eight (8) inches in thickness before compaction, and compacted by the use of pneumatic tampers or other mechanical means approved. Water or dry, as required, to bring the soils as close as practicable to the optimum moisture content for proper compaction. Compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive displacement or may damage the pipeline will not be permitted. Lifts of backfill shall be compacted to not less than 95% of maximum dry density as determined by the procedure set forth in ASTM Designation D1557. Jetting of backfill material will not be permitted.

D. Backfill will be inspected and tested by the Geotechnical Engineer during placement. Contractor shall cooperate with the Engineer and shall provide working space for such tests in his operations. Backfill not compacted in accordance with these specifications shall be recompacted, or removed as necessary and replaced to meet specified requirements prior to proceeding with the work.

END OF SECTION 33 31 00

SECTION 33 39 13 SANITARY UTILITY SEWERAGE MANHOLES, FRAMES, AND COVERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This item shall govern the manufacture, construction, and installation of sanitary sewer manholes. All manholes shall conform to TCEQ requirements. Submittal and approval shall be required for all pre-cast design.

1.02 SUBMITTALS

A. Submit manufacturer's data on materials furnished indicating compliance with the specifications regarding dimensions, thickness, weights, and materials.

B. Submit manufacturer's "Certificate of Compliance" stating that the materials furnished comply with this specification.

PART 2 – PRODUCTS

2.01 MATERIALS

A. CONCRETE

1. Refer to SECTION 03 30 00 -CONCRETE

B. MANHOLE RINGS AND COVERS

1. Lid and Frame: ASTM A48, Class 30B Cast iron construction, machined flat bearing surface, removable boltable lid, live load rating of H20 heavy traffic. Lids shall have the appropriate designation for sanitary sewerage and the City of Austin as called for on the details. All lids shall be gasketed and bolted type not less than 32" diameter.

C. GRADE RINGS

1. Grade rings shall be precast reinforced concrete. Minimum thickness shall be 2 inches by 8 inches wide by 30 inches inside diameter.

D. PRECAST REINFORCED MANHOLE SECTIONS

1. Precast manhole sections conform to the current ASTM C478 standard. Joints shall be O-ring gasketed. Thickness for manhole risers shall be as listed under wall "B" in the "Class Tables" of ASTM C76, Reinforced Concrete Pipe.

E. CONFIGURATION

1. Shaft Construction: Concentric with concentric or eccentric cone top section; lipped male/female joints; sleeve to receive pipe sections. All joints shall be leak-proof type acceptable for by the TCEQ for the Edwards Aquifer.

2. Shape: Cylindrical

3. Clear Inside Dimensions: 48 inch diameter, unless otherwise indicated on the drawings.

4. Design Depth: As indicated and/or required.

5. Clear Lid Opening: 32 inches diameter.

F. PRE-CAST MANHOLE BASES

1. Pre-cast manhole bases will conform to all TCEQ requirements and City Specifications for invert depths,

reinforcement, base thickness and manhole depth for pipe size.

G. DROPS

1. Drops shall be constructed of either ductile iron as specified in PIPE or PVC pipe. Drops shall be placed on the inside of a manhole using a cross to allow access to the vertical pipe. Cement stabilized sand should be used for all backfill around outside drop manholes.

H. COATINGS

1. Manholes shall be coated with Raven 405 or approved equal after in ground installation. Coating shall be from top to bottom and cover all inside surfaces of the manhole.

2.02 TESTING REQUIREMENTS

1. See SECTION 33 01 30 - TESTING OF GRAVITY SEWER SYSTEMS.

PART 3 – EXECUTION

3.01 INSTALLATION

A. MANHOLE BASES

1. Construct manhole bases in the configuration shown on the Plans. Minimum thickness below the flowline of sewer shall be 8 inches or as shown on the details.

2. Insure that bases are constructed or installed on firm ground and that ground water is controlled. Install appropriate material for a minimum of 4" to stabilize bottom if directed to do so by the Engineer.

3. The invert of manholes shall be formed in such a fashion that they are smooth and will not obstruct flow of sewage. Provide flow channels in the manhole base equivalent to the top of the pipe by forming the concrete base and trowelling it to a smooth, even finish with a steel trowel. Slope the manhole bench from the wall line to edge of flow channel and trowel it smooth on a grade of 1 inch per foot with a liberal radius applied at flow channel intercepts.

B. PRECAST MANHOLES

1. Precast Manhole bases shall be placed on a 6" minimum depth layer of cushion sand, gravel or pre-approved material. Cast bottom section of precast manhole riser ring in manhole base as shown on the Plans. Place "Synko-Flex" waterstop (or pre-approved equal) per manufacturer's recommendations prior to setting precast starter ring. The base shall have a minimum diameter 12 inches greater than the outside diameter of the manhole, and a minimum thickness including the area under the pipe as follows:

   a. 0' to 8' manhole ..... 6"

   b. greater than 8'..... 12"

2. All invert channels shall be smooth and accurately shaped to a semi-circular bottom conforming to the outside of the adjacent sewer section. Inverts shall be formed directly in the concrete of the manhole base or may be constructed by laying full section sewer pipe straight through the manhole and cutting out the top half after the base is constructed. Changes in the direction of the sewer and entering branches shall have a true curve of as large a radius as the size of the manhole will permit. Where the largest pipe at a manhole is less than 12", the channel depth shall be one half of the largest pipe diameter. When the largest pipe at the manhole is between 12 and 24 inches (inclusive,) the channel depth shall be three fourths of the largest pipe diameter. When the largest pipe at a manhole is greater than 24", the channel depth shall match the largest pipe. In all cases, the edges of the pipe along the invert and at the walls of the manhole shall be plastered and brush-finished. Plaster shall be non-shrink or hydraulic grout.

3. Where inlet leads, main or lateral pipe sewers enter manholes, pipes shall be cut off flush with inside of manhole any irregularities shall be grouted up with non-shrink grout. Install stub outs, where shown, to line and grade. Use one full joint of pipe, of size indicated, for stub out. Seal stub out with plug. Install plug in such a manner as to prevent seepage of leakage through stub outs. Installation of plug shall be such that it may easily be removed in future without damaging bell or groove end of stub out.

4. If manholes are constructed in streets where immediate subsequent paving or repaving is involved, readjust the manhole ring and covers, immediately prior to the paving operations. Manholes shall be installed with joints of size and numbers required to obtain correct depth. Contractor is responsible for verifying correct manhole depth before construction. Initially, manhole tops shall be not less than 6inches nor greater than 18-inches from final grade. If manholes are relocated in the field because of unforeseen conflicts, the Contractor is responsible for correct depth of manhole. Manhole tops shall be set as follows:

   a. Developed Areas: Set manhole tops 1-inch higher than existing elevation of natural ground or other final grade when specified by the Engineer.

   b. Undeveloped Areas: Set manhole tops flush with paved surfaces and 6-inches higher than shoulder and/or proposed final grade elevations in easements or other unpaved areas. Where manholes are located in bottom of ditches, either set manhole top by EJIW V-2342, or pre-approved equal, flush with ditch bottom and seal with solid cover, or set twelve inches above ditch top and reshape ditch around manhole.

5. Prior to placing each section of manhole riser or cone, thoroughly clean the bells and spigots to be joined.

6. Backfilling will be performed evenly and carefully around the manhole after the full strength of the concrete is attained.

7. Carefully place the O-ring gasket and check for proper alignment.

8. Plug lift holes, interior joints, and exterior joints with “Water Plug” grout.

9. Each manhole shall be individually vacuum tested according to the SECTION 33 01 30 – TESTING OF GRAVITY SEWER SYSTEMS. Stub-outs, boots, and pipe plugs shall be secured to prevent movement while the vacuum is being drawn.

C. CAST-IN PLACE MANHOLES

1. Cast-In place manholes are not allowed without prior approval from the Engineer. This approval shall only be in emergency situations.

D. FIBERGLASS MANHOLES

1. Fiberglass manholes are NOT permitted with without written approval from the Engineer.

E. SERVICE CONNECTIONS

1. Service connections at manholes will meet all other requirements of this specification and shall be tied into the manhole with a manhole boot. At the time of construction, the Engineer will designate the locations of the service outlets and the depth to the top of the lateral pipe, if depth is not indicated on the plans. The minimum depth of cover over the end of the lateral pipe shall be no deeper than what is required to serve the intended lot.

F. CLEANOUT STRUCTURES

1. The Contractor shall construct cleanouts where shown on the plans or as called out on the plans (every 50’ along private service lines except between manholes) and as specified. All backfill around and above the pipe shall be machine tamped in layers not exceeding 3 inches in depth so that no settlement shall occur after the

cleanout is constructed. Cleanouts shall be provided at each service connection and located at the edge of an easement or at the right-of-way. The cleanouts shall be enclosed within a meter box which has a lid that makes the cleanout accessible set flush with the ground.

G. DROP MANHOLES

1. Drop manholes shall be constructed for elevation differences of 24 inches or greater as measured from the flow line of the pipe to the flow line entrance of the manhole. Drop manholes shall be done inside for private onsite manholes and as per the local jurisdictions standard details for manholes outside the project site.

END OF SECTION 33 39 13

SECTION 33 41 00 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

Drawings and general provisions of Contract, as well as all the appropriate specification sections of Division 1, apply to work of this section.

1.01 SECTION INCLUDES

A. Site storm sewerage drainage piping, fittings and accessories, and bedding.

B. Connection of building storm water drainage system (rain leaders) to site storm sewerage system.

C. Catch basins, paved area drainage, and site surface drainage.

1.02 RELATED SECTIONS

A. Section 31 41 33 - Trench Shielding.

B. Section 03 30 00 - Cast-in-Place Concrete.

1.03 REFERENCES

A. AASHTO T180 - Moisture-Density Relations of Soils Using a 10-lb (4.54 kg) Rammer and an 18-in. (457 mm) Drop.

B. ANSI/ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

C. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

D. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch Drop.

E. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch Drop.

F. ANSI/ASTM D2729 - PVC Sewer Pipe and Fittings.

G. ASTM D3017 - Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures.

1.04 SUBMITTALS

A. Product Data: Provide data indicating pipe, pipe and accessories.

B. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Reinforced Concrete Pipe manufacturer must provide a notarized certificate stating that the RCP pipe provided for the School project is Class III and listing all diameters provided.

1.05 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.06 FIELD MEASUREMENTS

A. Verify that field measurements and elevations are as indicated.

1.07 COORDINATION

A. Coordinate the Work with termination of storm sewer connection outside building, connection to rain leaders from building, existing underground utilities to remain and the other utilities shown on the drawings.

1.08 CAUTION

A. Concrete pipe is NOT as hydraulically efficient as plastic pipe. Pipe called out on the drawings as PVC shall NOT be substituted with reinforced concrete pipe. However, PVC pipe of equal diameter may be used as a substitute wherever RCP is called out. Polyethylene material is NOT acceptable without approval of engineer, which if presented for consideration must have a substantial credit to Owner.

PART 2 - PRODUCTS

2.01 STORM SEWER PIPE MATERIALS

A. Reinforced Concrete Pipe: ANSI/ASTM C76, Class III with Wall Type A; mesh reinforcement; inside nominal diameter of 15 inches to 36".

B. Reinforced concrete fittings: pipe bends where shown on the drawings shall be factory made tongue and grove C-76 Class III pipe 45 degree bends. Field splices shall NOT be accepted.

C. Reinforced concrete fittings: wye connections where shown on the drawings shall be factory made tongue and grove C-76 Class III pipe 45 degree wyes. Field splices shall NOT be accepted.

D. Reducer fittings or couplings for the sizes and configurations shown on the drawings shall be required. Use eccentric collar joints with all inverts at the given slope. Field splices shall NOT be accepted.

E. Provide saddle connections for branch line joints to collector mains. Field splices shall NOT be accepted.

F. Reinforced Concrete Pipe Joint Device: preformed or mastic joint material. Preformed or mastic joint material shall be continuous throughout the entire circumference of each pipe.

G. Plastic Pipe: ANSI/ASTM D-1785, Schedule 40 PVC material; inside nominal diameter of 6 inches to 15 inches solvent sealed joint end.

H. Plastic pipe fittings: ASTM D-2665, Schedule 40 PVC material for standard wye and 45 degree bend fittings.

I. Corrugated HDPE storm sewer pipe: 4 through 60 inch Hancor Blue Seal WT IB pipe (per ASTM F2648) for use in gravity –flow land drainage applications with water tight joints.

2.02 CLEANOUTS

A. 6" dia. cleanout shall be placed at the end of each building rain leader.

B. 6” dia. cleanouts shall be placed at the end (upstream end) of all straight pipe runs.

2.03 BEDDING MATERIALS

A. Refer to . 31 23 33 – Trenching and Backfilling for bedding requirements.

2.04 MISCELLANEOUS MATERIALS

A. Gabion mats see Section 31 36 00 GABIONS for gabion requirements.

B. Geotextile fabric shall conform to U.S. Corps of Engineers Specification CW02215, November, 1977, and shall meet or exceed the following minimum criteria:

1.	Equivalent Opening Size (EOS)	70-100
2.	Tensile Strength (ASTM 1682)	200 lbs. minimum each direction
3.	Puncture Strength (ASTM D751)	80 lb., minimum
4.	Abrasion Resistance (ASTM D1175/D1682)	55 lb., minimum each direction

C. Perforated pipe shall consist of 6" dia. Schedule 40 PVC piping with min 3/8" dia., max. 3/4" dia. perforations spaced not to exceed 6" (or as required by Environmental Inspector). Schedule 40 PVC pipe shall meet all of the requirements of ASTM D-1785. Schedule 40 fittings shall meet all of the requirements of ASTM D-2665 for DWV PVC Schedule 40 fittings.

D. Perforated pipe shall be wrapped with geotextile fabric to prevent the gravel layer from entering the perforations and stopping the flow.

E. Gravel Layer shall consist of 2' wide 6" min. high gravel mound over perforated pipe (2" min. on top of pipe). Gravel (aggregate) shall consist of crushed stone with a minimum specific gravity of 2.25 and shall have a percent of wear no greater than 30 when tested by the Los Angeles Abrasion Test, ASTM C131.

F. Gravel material shall meet the following grading requirements, ASTM D421-58 and ASTM D422-63:

1.	Retained on 1 3/4" sieve	0% - 10%
2.	Retained on 1 1/2" sieve	5% - 35%
3.	Retained on 3/4" sieve	70% - 90%
4.	Retained on 3/8" sieve	95% - 100%

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fine aggregate or lean concrete.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

3.03 BEDDING

A. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level materials in continuous layer not exceeding 8 inches compacted depth.

C. Maintain optimum moisture content of bedding material to attain required compaction density.

3.04 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with ASTM C12 and manufacturer's instructions. Seal joints watertight.

B. Place pipe on minimum 8 inch deep bed of bedding material.

C. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch 10 feet.

D. Install aggregate at sides and over top of pipe. Provide top cover to minimum compacted thickness of 12 inches, compact to 95 percent .

E. Refer to Section 31 41 33 for trenching requirements. Do not displace or damage pipe when compacting.

F. Refer to Section 33 49 13 for manhole requirements.

G. Joining pipe of different materials shall be achieved by the use of fittings and or couplings made for the pipe materials joining.

H. Joining pipe of different sizes shall be achieved by the use of reducer fittings of the required sizes and configurations. Contractor shall use approved saddle connections when branch line join a main or collector main. The use of eccentric connectors shall be required. "Mortaring" of the pipes will not be accepted for any joint. Reinforced concrete collar may be proposed in writing with shop drawings showing dimensions of concrete collar, and reinforcement. Reinforced concrete collars may not be used unless approved by Engineer.

3.05 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place pad, with provision for storm sewer pipe end sections.

C. Level top surface of cleanout wye to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured cleanout vertical section to elevation indicated.

3.06 INSTALLATION GABIONS:

1. Refer to Section 31 36 00 GABIONS for installation procedures.

3.07 FIELD QUALITY CONTROL

A. Request inspection prior to and immediately after placing aggregate cover over pipe.

B. Compaction testing will be performed in accordance with ANSI/ASTM D1557.

C. If tests indicate Work does not meet specified requirements, remove work, replace and retest.

3.08 PROTECTION

A. Protect finished Work.

B. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.

3.09 GENERAL BACKFILLING

A. Backfill shall be as shown in 31 23 33 Trenching and Backfilling. Place in 6-inch maximum loose lifts to one foot above pipe unless otherwise specified. Bring up evenly on each side, and for the full length of the structure. Ensure that no damage is done to structures or protective coatings thereon. Place the remainder of the backfill in 8-inch maximum loose lifts unless otherwise specified. Compact each loose lift as specified in Paragraph "General Compaction" before placing

the next lift. Where unacceptable settlements occur in trenches and pits due to improper compaction, excavate to the depth necessary to rectify the problem, then backfill and compact the excavation as specified herein and restore the surface to the required elevation.

B. No backfill shall be placed until the line has been inspected and approved for backfilling.

3.10 GENERAL COMPACTION

A. Use hand-operated plate type vibratory or other suitable hand tampers in areas not accessible to larger rollers or compactors. Be careful to avoid damaging pipes and protective pipe coatings. Compaction shall be in accordance with the following unless otherwise specified. If necessary, the Contractor's selected equipment and construction procedure shall be altered, changed or modified in order to meet the specified compaction requirements.

B. Initial backfill and bedding shall be carefully packed under the haunches of the pipe and brought up simultaneously on both sides so as to obviate any displacement of the pipe from its true alignment. Bedding shall be compacted in layers not more than eight (8) inches in thickness in a manner that will preclude moving the pipe, to not less than 95% of maximum dry density as determined by the procedure set forth in ASTM Designation D1557. Jetting of backfill material will not be permitted.

C. Select backfill above the initial backfill shall be placed in loose lifts not exceeding eight (8) inches in thickness before compaction, and compacted by the use of pneumatic tampers or other mechanical means approved. Water or dry, as required, to bring the soils as close as practicable to the optimum moisture content for proper compaction. Compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive displacement or may damage the pipeline will not be permitted. Lifts of backfill shall be compacted to not less than 95% of maximum dry density as determined by the procedure set forth in ASTM Designation D1557. Jetting of backfill material will not be permitted.

D. Backfill will be inspected and tested by the Geotechnical Engineer during placement. Contractor shall cooperate with the Engineer and shall provide working space for such tests in his operations. Backfill not compacted in accordance with these specifications shall be recompacted, or removed as necessary and replaced to meet specified requirements prior to proceeding with the work.

END OF SECTION 33 41 00

SECTION 33 49 13 - STORM DRAINAGE MANHOLES, FRAMES AND COVERS

PART 1 - GENERAL

Drawings and general provisions of Contract, as well as all the appropriate specification sections of Division 1, apply to work of this section.

1.01 SECTION INCLUDES

A. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage and accessories.

1.02 RELATED SECTIONS

A. Section 31 22 13 - Rough Grading

B. Section 32 13 13 – Concrete Paving.

1.03 REFERENCES

A. ANSI/ASTM C55 - Concrete Building Brick.

B. ASTM A48 - Gray Iron Castings.

C. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

D. ASTM C923 - Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.

1.04 SUBMITTALS

A. Shop Drawings: Indicate manholes locations, elevations, piping, sizes and elevations of penetrations.

B. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Hanson.

B. Capital Precast

C. Park Equipment

2.02 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 with gaskets in accordance with ASTM C923. All joints shall be leak-proof type acceptable for by the TCEQ for the Edwards Aquifer.

2.03 COMPONENTS

A. Lid and Frame: ASTM A48, Class 30B Cast iron construction, machined flat bearing surface, removable boltable lid, live load rating of H20 heavy traffic. Lids shall have the appropriate designation for storm sewerage and the City of New Braunfels as called for on the details. All lids shall be gasketed and bolted type not less than 32" diameter.

A. Base Pad: Cast-in-place 3000 psi structural concrete of type specified in Section 03300, leveled top surface.

2.04 CONFIGURATION

A. Shaft Construction: Concentric with concentric or eccentric cone top section; lipped male/female joints; sleeve to receive pipe sections. All joints shall be leak-proof type acceptable for by the TCEQ for the Edwards Aquifer.

B. Shape: Cylindrical

C. Clear Inside Dimensions: 72 inch diameter, unless otherwise indicated on the drawings.

D. Design Depth: As indicated and/or required.

E. Clear Lid Opening: 26 inches diameter.

2.05 CATCH BASINS

A. Lid and Frame: Cast iron construction, hinged lid, as called for on the drawings.

B. Catch basin shall be constructed of 3000 psi concrete as called for in Section 33 00 00 of these specifications, and as shown on the drawings. Precast products from Hanson or Captial Precast designated for H20 loading will be accepted only with a shop drawing submittal.

C. All Grates in pedestrian areas shall be heavy duty (H20 loading) with maximum 7/16" opening for handicapped accessibility.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into Work.

C. Verify excavation for manholes is correct.

3.02 PREPARATION

A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 PLACING MANHOLE SECTIONS

A. Place base pad, trowel top surface level.

B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.

C. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

D. Set cover frames and covers level without tipping, to correct elevations.

E. Coordinate with other sections of work to provide correct size, shape, and location.

3.04 INSTALLATION - CATCH BASINS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for storm sewer pipe end sections.

C. Level top surface of base pad to receive concrete shaft sections, sleeved to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.05 SCHEDULES

A. Storm Sewer Manholes: Precast concrete sections, no steps required, 48 inch inside dimension minimum or as indicated on the drainage plan, to depth indicated, with bolted lid.

B. Catch basin. Precast products from Hanson or Captial Precast designated for H20 loading will be accepted only with a shop drawing submittal.

C. Lid and Frame: Cast iron construction, hinged lid, as called for on the drawings. All Grates in pedestrian areas shall be heavy duty (H20 loading) with maximum 7/16" opening for handicapped accessibility.

END OF SECTION 33 49 13

SECTION 33 51 13 - NATURAL GAS DISTRIBUTION

PART 1 – GENERAL

1.01 DESCRIPTION:

A. Outside underground gas distribution system for natural gas, complete, ready for operation, including cathodic protection if required, all appurtenant structures, and connections to new building structures and to existing gas supply. This specification does not apply to LPG distribution systems.

1.02 RELATED WORK:

A. Section 31 22 13 - Rough Grading

B. Section 31 41 33 – Trench Shielding.

C. Section 03 30 00, Cast-In-Place Concrete.

1.03 DEFINITIONS

A. Gas Main or Distribution Main: A distribution line that serves as a common source of supply for more than one service line.

B. Gas Service Line: A distribution line that transports gas from a common source of supply to the meter set assembly.

1.04 QUALITY ASSURANCE:

A. Approval by Engineer and or ATMOS ENERGY is required of products or services of proposed manufacturers, suppliers and installers, and will be based upon submission by Contractor for certification that:

1. The design and size of each item of equipment provided for this project is of current production and has been in satisfactory and efficient operation on at least three installations for approximately 3 years. If elements of equipment lack a substantial experience record, such lack shall be brought to the attention of the Engineer and ATMOS ENERGY at the time of submission of shop drawings, with full information included to permit proper evaluation.

B. Apply and install materials, equipment, and specialties in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract drawings and specifications shall be referred to the Design Engineer (DE) or ATMOS ENERGY Technical Representative (OTR) for resolution. Provide copies of installation instructions to the DE or OTR prior to commencing installation of any item.

C. All equipment shall be free from defects which would adversely affect the performance, maintainability and appearance of individual components or overall assembly.

D. Assembly of Plastic Piping: Installation personnel shall have been trained, tested and certified under a procedure approved by the manufacturer of the piping. Proof of certification, in writing, shall be provided to the OTR or DE.

E. Contractor shall conform to applicable local codes, American Society of Mechanical Engineers Gas Transmission and Distribution Piping Systems, publications of the Underwriters' Laboratories, Inc., National Fire Protection Association, Federal Specifications, American Society of Testing Materials, and current safety standards, all as defined in the Article of the Specifications relating to Applicable Publications.

F. Comply with rules and regulations of the local utility having jurisdiction in all cases where gas lines are connected to public Utility Services.

1.05 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Piping:

1. ASTM Compliance.
2. Grade, class or type, schedule number.
3. Manufacturer's Certification of Compliance with specified standards.

C. Pipe Coatings:

1. Manufacturer's Certification of Compliance with specified standards.
2. Federal Specification Compliance.

D. Pipe Fittings and Flanges:

1. ASTM Compliance.
2. Grade, class or type, schedule number.
3. Catalog Cuts.
4. Pressure and Temperature Rating.

E. Manual Valves:

1. Type and service.
2. Catalog Cuts.
3. Pressure and Temperature Ratings.

F. Valve Boxes:

1. Catalog Cuts

G. Gas Filter:

1. Catalog Cuts.
2. Removal Efficiency, Pressure and Temperature Rating.

H. Gas Pressure Regulator:

1. UL Listing.
2. Pressure and Temperature Rating.
3. Flow Capacities.
4. Catalog Cuts.

I. Meter:

1. ANSI Compliance.

2. Pressure and Temperature Rating.

3. Certification of Compliance with local utility requirements.

J. Cathodic Protection System:

1. If Required by ATMOS ENERGY DE.

K. Certificate to indicate compliance with pressure tests on gas system.

1.06 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. American National Standards Institute (ANSI):

1. B1.20.1 Malleable-Iron Threaded Fittings: Threads

2. B16.3-98 Malleable-Iron Threaded Fittings: Dimensions and Pressure Rating

3. B16.5-03 Pipe Flanges and Flanged Fittings, NPS 1/2 Through NPS 24

4. B16.9-03 Factory-Made Wrought Steel Buttwelding Fittings

5. B16.11-01 Forged Steel Fittings, Socket-Welding and Threaded

6. B16.34-97 Valves-Flanged, Threaded, and Welding End

7. B16.40-94 Manually Operated Thermoplastic Gas Shutoffs and Valves in Gas Distribution Systems

8. B31.8-95 Gas Transmission and Distribution Piping Systems

9. B109.2-92 Diaphragm Type Gas Displacement Meters

C. American Petroleum Institute (API):

1. API Spec 6D-94 Pipeline Valves (Gate, Plug, Ball, and Check Valves)

D. American Society for Civil Engineers (ASCE):

1. 25-97 Earthquake Actuated Automatic Gas Shutoff

E. American Society for Testing and Materials (ASTM):

1. A197 Malleable Threaded Fittings, classes 150 and 300, and Unions.

2. A53M-04a Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

3. A126-04 Gray Iron Castings for Valves, Flanges, and Pipe Fittings

4. D450-00e1 Coal-Tar Pitch Used in Roofing, Dampproofing and Waterproofing

5. D2513-03 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

6. D2517-00e1 Reinforced Epoxy Resin Gas Pressure Pipe and Fittings

7. D3350-00 Polyethylene Plastics Pipe and Fittings Materials

F. American Water Works Association (AWWA):

1. C203-02 Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied

G. National Fire Protection Association (NFPA):

1. 54-02 National Fuel Gas Code

PART 2– PRODUCTS

2.01 PIPE:

A. Black Steel: Seamless or ERW, ASTM A53, Grade B, Schedule 40.

1. Shop-applied pipe coating shall be one of the following types:

a. Coal Tar Enamel Coating: Exterior of pipe and fittings shall be cleaned, primed with Type B primer and coated with hot-applied coal-tar enamel with bonded layer of felt wrap in accordance with AWWA C203. Asbestos felt shall not be used; felt material shall be fibrous-glass mat as specified in Appendix Sec. A2.1 of AWWA C203.

b. Adhesive-Thermoplastic Resin Coating: Fed. Spec. L-C-530, Type I.

c. Adhesive-thermosetting Resin Coating: Fed. Spec. L-C-530, Type II.

2. Field-applied plastic tape material for use on pipe joints and for repairing damaged areas of shop-applied coatings shall conform to Fed. Spec. L-T-1512, Type I, 250 μm (10 mils) nominal thickness for pipe joints, and Type II, 500 μm (20 mils) nominal thickness for coating repairs.

B. Polyethylene Pipe: Pipe and tubing shall conform to ASTM D3350 AND ASTM D2513, pipe designations PE 2406 and PE 3408. Minimum wall thickness shall conform to ANSI/ASME B31.8. PE pipe is for underground use only. Polyethylene pipe shall be marked “GAS” and it is not be used where gas pressures are above 690 kPa (100 psi) or with operating temperatures below 7 degrees C (20 degrees F) or above 60 degrees C (140 degrees F).

C. Fiberglass pipe shall conform to ASTM D2517. Pipe sections shall be marked “GAS” and as required by ASTM D2517. Minimum wall thickness shall be based on B31.8. Fiberglass pipe shall not be used where gas pressures are above 690 kPa (100 psi) or with operating temperatures below 29 degrees C (-20 degrees F) or above 66 degrees C (150 degrees F).

2.02 FITTINGS:

A. Steel Pipe:

1. Butt weld fittings shall be wrought steel, ANSI B16.9.

2. Socket weld fittings shall be forged steel, 13.8 MPa (2000 Psi class), ANSI B16.11.

3. Threaded fittings shall be malleable iron, ANSI 16.3 or forged steel, ANSI B16.11.

4. Flanges shall be steel, Class 150 //[ ]//, ANSI B16.5.

B. Polyethylene Plastic Pipe Fittings: ASTM D2513.

C. Fiberglass: Shall conform to ASTM D2517.

2.03 JOINTS:

A. Socket or butt welded for steel pipe, ANSI B31.8. Threaded joints not permitted except at valve connections.

B. Polyethylene pipe joints shall be heat fusion, either butt fusion or socket fusion.

C. Fiberglass joints and adhesive shall conform to ASTM D2517.

2.04 VALVES:

All types of valves shall be accessible, labeled and specified for use for controlling multiple systems.

A. Manual: Valves shall be suitable for shutoff or isolation service

1. Lubricated plug type for gas service shall be cast iron, semi-steel or cast steel. Valves shall have capacity to operate in lines with 690 kPa (100 psi) working pressure. Steel valves 40 mm (1-1/2 inches) and smaller installed underground and shall conform to ASME B16.34, carbon steel, socket weld ends. Steel valves 40 mm (1-1/2 inches) and smaller, installed above ground, shall conform to ASME B16.34, carbon steel, socket weld or threaded ends. Steel valves 50 mm (2 inches) and larger shall conform to API spec 6D, carbon steel, buttweld ends, Class [ ] for underground installations. Above ground steel valves 50 mm (2 inches or larger) shall conform to API Spec 6D, carbon steel, buttweld or flanged ends, Class [ ]. Cast iron valves shall conform to ASTM A126, Class B, Type 301 or 302.

a. Underground: 50 mm (2 inch) nut for socket wrench operation.

b. Above Ground and In Pits: Lever operation, locking type. Provide one lever for each valve.

B. Polyethylene Valves:

1. 1. Valves shall conform to ASME B16.40. Polyethylene valves, in sizes 15 mm to 150 mm (1/2 inch to 6 inches) may be used with polyethylene distribution and service lines, in lieu of steel valves, for underground installation only

2.05 VALVE BOXES:

A. Cast iron extension box with screw or slide type adjustment and flared base. Minimum thickness of metal, 5 mm (3/16 inch). Box shall be of such length as can be adapted, without full extension, to depth of cover required over pipe at valve location.

B. Cast the word "GAS" in cover.

C. Provide 2 "T" handle socket wrenches of 16 mm (5/8 inch) round stock long enough to extend 600 mm (2 feet) above top of deepest valve box.

D. Provide box with heavy coat of bituminous paint.

2.06 PIPE SLEEVES:

A. Ductile iron or coated steel.

2.07 GAS FILTER:

A. Replaceable glass-fiber or cellulose cartridge with 10 micron particle retention. Filter enclosure shall be pipe size of the regulator or larger as required by pressure drop considerations. Lockup pressure of the supply service will be provide by ATMOS ENERGY.

B. Plug all drains or instrumentation outlets. Provide vent with cock for relieving pressure in filter.

2.08 METERS:

A. Gas meters shall be furnished and installed by local gas Utility as specified herein.

B. Meters shall comply with ANSI B109.2. Meters shall be pedestal // mounted. Meters shall be provided with over-pressure protection as specified in ASME B31.8 , tamper-proof protection, frost protection , and fungus-proof protection . Meters shall be suitable for accurately measuring and handling gas at pressures, temperatures, and flow rates indicated. Meters shall have a pulse switch initiator capable of operating up to speeds of 500 pulses per minute. Meters shall be protected from any damage.

2.09 WARNING TAPE:

A. Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable type, yellow with black letters, and imprinted with "CAUTION BURIED GAS LINE BELOW".

PART 3 – EXECUTION

3.01 GAS MAINS:

A. Pipe for gas mains shall be steel or polyethylene Steel pipe and fittings shall be coated with protective covering as specified. Polyethylene mains shall not be installed above ground.

3.02 BUILDING SERVICE LINES:

A. Install gas service lines to point of connection within approximately 1500 mm (5 feet) outside of buildings to which such service is to be connected and make connections thereto. The point of delivery is the service regulator or shutoff valve.

B. Where building services have not been installed, provide temporary caps.

C. Connect service lines to top of mains by two-strap service clamp or coupling (socket) welded to main and into which is screwed a street tee and street elbow swing, joint assembly.

D. The service lines shall be as short and as straight as practicable between the point of delivery and the gas main and shall not be bent or curved laterally unless necessary to avoid obstructions or otherwise permitted. Service lines shall be laid with as few as joints as practicable using standard lengths of pipe. Polyethylene or fiberglass service lines shall not be installed aboveground except as permitted in ANSI B31.8.

3.03 PIPE INSTALLATION, GENERAL:

A. Gas distribution system and equipment shall be installed in accordance with the manufacturer's recommendations and applicable sections of B31.8 and NFPA 54.

B. Excavation and backfilling shall be as specified in Section 31 23 33 TRENCHING AND BACKFILLING.

C. Heating trenches, storm and sanitary sewer lines, and water mains shall have right of way.

D. Warning tape shall be continuously placed 300 mm (12 inches) above buried gas lines.

E. Make service connections at the top of the main, whenever the depth of the main is sufficient to allow top connections. When service connections cannot be made at the top of the main, they shall be made on the side of the main as close to the top as possible. Service connections shall not be made lower than the horizontal midpoint of the gas main.

F. Before entering building, underground service line shall rise above grade close to building to permit possible gas leaks to vent themselves.

G. Main services and main service shut off valves shall have a 600 mm (24 inch) minimum cover or as recommended by local utility.

H. Service lines shall have a 450 mm (18 inch) minimum cover or as recommended by local utility.

I. Where indicated, the main shall be concrete-encased or sleeved. Non-metallic pipe to be concrete encased shall be sleeved as indicated. The sleeve shall be sloped and vented to atmosphere at the highest point or where shown. //

J. Connections between metallic and plastic piping shall be made only outside, underground, and with approved transition fittings.

3.04 NON-METALLIC PIPE INSTALLATION:

A. Install pipe in trench in accordance with recommendations of the pipe manufacturer. Provide sufficient slack to allow for expansion and contraction.

B. Joints: Fusion welds shall be made in accordance with the recommendations of the polyethylene pipe manufacturer. Adhesive joints for fiberglass plastic pipe shall be made in accordance with manufacturer's recommendations.

C. All offsets in piping shall be made with manufactured fittings. Bending of piping to form offsets shall not be permitted.

D. Connections between plastic pipe and metal pipe shall be made in accordance with recommendations of the pipe manufacturer.

E. Copper Tracer Wire: Copper tracer wires consisting of No. 14 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape. At least every 300 m (1000 feet), provide a 2.3 kg (5 pound) magnesium anode attached to the main tracer wire by solder joint shall be wrapped with rubber tape and with electrical tape. An anode shall be attached at the end of each line.

3.05 APPLICATION OF PLASTIC TAPE:

A. Field apply plastic tape to steel pipe joints and damaged areas of coatings after pressure tests.

B. Clean and free of burrs and rust, joint areas before taping. Damaged coating shall be smoothed down or cut away if not firmly bonded to the pipe.

C. Wrap spirally with a two-layer wrapping system, overlapping the coating surface at least 75 mm (3 inches). Initially stretch tape sufficiently to conform to the surface to which it is applied, using one layer half-lapped for tape 50 mm (2 inches) or less in width, or one layer lapped at least 25 mm (1 inch) for tape more than 50 mm (2 inches) wide.

D. A second layer lapped as above, with a tension as it comes off the roll shall then be applied and pressed to conform to the shape of the component.

3.06 SETTING VALVES:

A. Do not install valves under pavement unless shown on drawings.

B. Clean valve interior before installation.

3.07 VALVE BOXES:

A. Set cover flush with finished grade.

B. Protect boxes located in roadway against movement by a concrete slab at least 900 mm (3 foot) square by 150 mm (6 inches) deep.

C. Set other valve boxes with a concrete slab 450 mm (18 inches) by 450 mm (18 inches) by 150 mm (6 inches) deep and set flush with grade.

D. All exposed portions of valve boxes shall be painted "Traffic Yellow."

3.08 PIPE SLEEVES:

A. Pipe shall be continuous through sleeves. Set sleeves in place before concrete is poured.

B. Seal between sleeve/core opening and the pipe with modular mechanical type link seal.

C. Provide where gas lines pass through retaining walls, foundation walls or floors. Split sleeves may be installed where existing lines pass thru new construction.

3.09 DRIPS:

A. Drips shall be provided where indicated or as a minimum where piping turns from a horizontal run to a vertical rise. Drips shall conform to the detail shown or may be of commercial units of approved type and capacity.

B. Automatic Ball Drips: Cast brass 20 mm (3/4 inch) in-line automatic ball drip with both ends threaded with iron pipe threads.

3.10 PIPE CLEANING:

A. All pipe sections shall be blown down with 690 kPa (100 psi) air to remove all sand, soil and debris.

B. Blow down procedure shall be done after system is complete, but before valves are installed.

3.11 FILTER, PRESSURE REGULATOR AND METER INSTALLATION:

A. Filter, pressure regulator and meter installation shall be installed per manufacturer's recommendations and per NFPA 54.

3.12 CATHODIC PROTECTION:

A. Where soil resistivity is less than 4000 ohm-cm or when required by gas utility.

B. Buried metallic gas pipe, fittings, and accessories shall be shop coated as previously specified and cathodically protected (furnish cathodic protection test kit.)

C. Valves and other metallic components installed on buried plastic piping shall be shop coated and cathodically protected (furnish cathodic test kit.)

D. Installation of Anodes:

1. Place anodes into augured holes by grasping the cloth gathered at top of packaged anode.

2. Replace ruptured anode packages with undamaged ones. Under no circumstances lower anode into hole by lead wire alone.

3. Presoak packaged anodes in water for at least 15 minutes prior to installation. Pour a minimum of 11 L (3 gallons) of water over anode after it has been positioned in the augured hole.

4. Tamp fine dirt or paddled around anode to insure contact between anode and native earth.

5. Adequate slack in the lead wire to preclude tearing lead wire loose during backfilling and compacting procedures.

6. Locate anodes so that minimum distance of 920 mm (36 inches) is maintained between anode and structures to which it is to be attached.

7. Connect lead wire to piping by using the thermite welding process.

8. Connection shall be waterproofed by use of cold applied, coal-tar pitch conforming to ASTM D450, and then covered by a pipeline felt or similar patch prior to backfilling.

E. Test Stations:

1. Provide a test station for each 10 anodes to permit testing for performance of the cathodic protection system. Use No. 12 stranded copper wire, TW covered, connected to the pipe by the termite welding process.

2. Make connections waterproof by application of coal tar pitch conforming to ASTM D450.

3. Leave adequate slack in the test leads to assure that the test leads will not be torn loose during backfill or compacting operations.

3.13 TESTS:

A. Piping System: Inspection, testing and purging shall be in accordance with NFPA 54 and B31.8. Maximum working pressure will be (100 psi).

B. Cathodic Protection System:

1. Testing of Anodes: Prior to connecting anode lead wire to the piping, insert a millimeter in the circuit and measure and record current output of each anode. When maximum current outputs, as set below, for the different sizes of anodes are exceeded, insert nickel chromium resistance wire in the circuit to reduce current output to maximum allowable for a given size anode. Resistance wire connections to anode lead wires shall be accomplished with silver solder and soldered joints wrapped with a minimum of three layers of high dielectric strength electrical tape. Cover with rubber all nickel chromium resistance wire. Maximum allowable current outputs for the different size anodes to allow for design life are as follows:

Weight (Bare Anodes)	Allowable Current Output
2.3 kg (5 lb) Anode	10 Milliamperes
4 kg (9 lb) Anode	20 Milliamperes
7.7 kg (17 lb) Anode	40 Milliamperes
14.5 kg (32 lb) Anode	75 Milliamperes

2. Final Test: Final test of the cathodic protection system shall include measuring pipe-to-soil potentials over the entire system. Make potential measurements with potentiometer voltmeter (minimum internal resistance of 50,000 ohms per volt) and a copper/copper sulfate reference electrode placed at the finished grade level and directly over the pipe. Adequate number of measurements shall be taken over the extent of piping to insure that a minimum potential value of -0.85 volts exists over all new gas piping. Upon completion of testing, a report setting forth potential values acquired by location shall be submitted to the Owner.

END OF SECTION 33 51 13

GEOTECHNICAL REPORT

SKG ENGINEERING, LLC

Geotechnical Report

Proposed Brady ISD Career Center

2301 Highway 190, Menard Highway

Brady, Texas 76825

SKG Engineering, LLC
F-7608
2/20/2019

PREPARED FOR:
Mr. Duane Limbaugh
Brady ISD Superintendent
1003 West 11th Street
Brady, Texas 76825

February 2019

19-E-0129

SKG
ENGINEERING, LLC
FIRM REGISTRATION NUMBER F-7608
SURVEYING ♦ ENVIRONMENTAL ♦ LAB/CMT

706 SOUTH ABE STREET
SAN ANGELO, TEXAS 76903

PHONE: 325.655.1288
FAX: 325.657.8189

February 20, 2019

19-E-0129

Mr. Duane Limbaugh
Brady ISD Superintendent
1003 West 11th Street
Brady, Texas 76825

Subject: Geotechnical Report, Proposed Brady ISD Career Center,
2301 Highway 190, Menard Highway, Brady, Texas

Mr. Limbaugh,

In accordance with your authorization, SKG Engineering has completed its geotechnical investigation at the referenced site. The work was done in accordance with the proposal dated the 20th day of December, 2018. The data and results are included in the attached report.

If you have any questions or comments, or if we can be of any more service to you, please do not hesitate to contact us at (325) 655-1288.

Sincerely,
SKG Engineering, LLC

Caleb J. Miller

Caleb Miller, E.I.T

Jason Clinton, P.E.

SKG Engineering, LLC
F-7608

Attachments - Geotechnical Report

CC: File

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Table of Contents

Attachments

1.0 Introduction

1.1 Overview

The purpose of this exploration was to determine subsurface materials and conditions and to establish the characteristics of these materials in order to recommend the criteria by which to establish foundation and pavement recommendations for the proposed single story career center. A summary of field conditions is included in Attachment A.

2.0 Exploration

2.1 Soil Borings

The subsurface explorations were conducted on this site in February 2019. The site has a general slope from the northwest towards the southeast. The boreholes were drilled to a maximum depth of 20', and the logs of these boreholes are included in this report. The drilling was performed with a truck mounted air rotary drill rig. The drilling activities were performed in accordance with accepted methods and procedures. The boreholes were conducted within the limits of the proposed building and parking areas. A location map showing the approximate borehole locations is included in Attachment B.

Material samples were recovered at various depths for testing. The primary means of extracting subsurface soil samples was by the use of a 3" Shelby-tube and/or a 2" O.D. split barrel sampler. Split spoon sampling procedures were performed in accordance with ASTM D 1586 and Shelby tube samples were obtained in accordance with ASTM D 1587. The samples were extruded or removed in the field and placed in moisture tight bags and labeled. The samples were then transported to the laboratory for testing and visual evaluation by geotechnical personnel. The Unified Soil Classification System was utilized in accordance with ASTM D 2487 to verify field classifications. Refer to the logs of borings located in Attachment C for lithology, sample locations and quantities.

2.2 Laboratory Tests

Tests were performed to determine engineering characteristics of the subsurface materials encountered including, but not limited to, soil moisture content (ASTM D 2216), Atterberg Limits (ASTM D 4318) and sieve analysis. The test results can be found in Attachment D. Samples not tested in the laboratory will be retained for a maximum of 60 days and then discarded unless otherwise notified in writing prior to disposal of the samples.

3.0 Subsurface Investigation

3.1 Site Geology

Based on the location of the site on geological maps, it is our opinion that the predominate soil is the Cho-Mereta association (CMB). These particular soils are indicative of gently undulating topography across plains. These soils are well drained and have slow surface runoff. Shrink-swell potential and soil corrosivity to uncoated steel are moderate. Based on the location of the site and soil conditions we do not foresee any adverse issues related to elevated sulfate concentrations.

3.2 Subsurface Materials and Conditions

The specific subsurface stratum encountered in each borehole is described in the logs of boreholes included in Attachment C. The strata encountered at the boreholes conducted at the site can be divided into five major strata. The first stratum is a layer of fat clay which extends from a depth of 0' to 7'. The third stratum consists of lean clay extending from 7' to 13'. The fourth stratum consists of clayey sand

with gravel extending from 13' to 17'. The final stratum consists of sandy lean clay which extends from 17' to the depth of the boreholes.

The subsurface stratum varies from those stated above as follows:

B1 – Cemented clayey sand with gravel encountered at a depth of 13 feet to a depth of 15 feet;
B2 – Sandy lean clay encountered at a depth of 0 feet to 2 feet.

3.3 Subsurface Water

There was groundwater noted in boreholes at the time of the investigation. Refer to the logs of borings located in Attachment C for specific water levels. The groundwater noted in the boreholes does not express or imply a groundwater study was performed, which is beyond the scope of this report. It should be noted that groundwater levels are subject to change based on seasonal and climatic conditions. Projects that include excavations or pier drilling should determine how the presence of groundwater will affect their scope of work and perform any due diligence work prior to mobilizing equipment to the site.

4.0 Site and Design Considerations

4.1 Basic Considerations

The properties of in-situ soils, site characteristics, and the level of tolerable deflection should be carefully considered during the design phase. A foundation should economically meet the functional requirements of the structure and minimize differential movement of the structure that could cause damage.

There site is currently developed with structures, roads, and parking lots. Some of the current developments fall within the footprint of the proposed career center. Any structures or pavement which fall within the proposed footprint should be removed in their entirety and engineered fill should be used to fill the excavated areas. The fill should be placed and compacted in accordance with the Site Preparation section of this report.

The depth and hardness of the subsurface cemented soil strata and gravel present varies across the site. The cemented soils and gravel noted may prove to hinder pier drilling activities at the site. The cemented soils were not considered rock at the borehole locations. The variations should be noted by the engineer and contractor for all aspects of design and construction.

Routing of drainage should be addressed in the design phase of the project to ensure drainage is routed away and around proposed and existing foundation systems.

4.2 Subsurface Moisture

Water, in the form of a liquid, can rise upward through subsurface soils by capillary action, absorption or gravitational pull well above the water table. Water changes from a liquid to a vapor as it evaporates. Water vapor will move from areas of high vapor pressure to a lower vapor pressure through diffusion. Diffusion is how water vapor distributes itself above the water table and occurs in both soils and concrete.

It is generally recognized that the relative humidity in the soils below a foundation will be close to 100%. Such a high relative humidity is reached even when the moisture content in the material below the foundation is found to be low. Without a capillary break or vapor barrier below the foundation, a high relative humidity or water source below a foundation can contribute moisture to the concrete. This can cause soluble alkalis in the concrete to enter into solution thus raising the pH. Moisture induced pH levels in concrete can be on the range of 10 to 12 while normal cured levels can be on the range of 7 to 9.

The impact of subsurface moisture can be reduced by the use of a vapor barrier or capillary break. A vapor barrier below the foundation is recommended when floor coverings or adhesives are sensitive to moisture or alkaline conditions. A vapor barrier can be in the form of poly vinyl sheets and a capillary break can be a sand or granular base. Verification of the vapor emission limitations from the foundation is vital to the selection of the proper vapor barrier system.

4.3 Shrink/Swell Considerations

Shrink/swell movements of the in-situ soils with changes in the soil moisture content are anticipated to be medium at the site. The Potential Vertical Rise (PVR) was calculated to be on the order of 1-1/2" using the McDowell PVR Method. The PVR was approximated using the McDowell's initial dry soil condition and a potential active zone to fifteen feet below grade. The intent of this section is to provide for a soil removal and replacement for the depths noted below. No finished floor elevations were provided at the time of this report and consideration of specific elevations would have to be reviewed when additional information is available.

The PVR can be reduced to be on the order of 1" by providing a 3' layer of engineered fill below the foundation. The PVR can be reduced to be on the order of ½" by providing a 5' layer of engineered fill below the foundation. When engineered fill is utilized to reduce the PVR, the continuous footings must bear at the same depth as the depth of the engineered fill or engineered fill should be placed below the grade beam to accomplish the required depth. Refer to the Engineered Fill section for placement and specifications.

The PVR and moreover foundation movement is effected by many factors that influence its magnitude and rate of change. Factors include: seasonal variations in the moisture content between the interior and perimeter of the foundation, topographic relief, vegetative cover, confining pressures, fluctuating and shallow water tables, and the composition of underlying soils. In-situ clays can expand with the introduction of moisture and shrink with decreases in moisture.

4.4 Foundation System and Recommendations

We recommend an adequately reinforced slab on grade foundation system with grade beams placed as determined by the structural engineer with spread footings to support concentrated point loads and provide lateral stability where necessary. Pier parameters are provided herein, if the structural engineer chooses to utilize a foundation supported by piers.

4.4.1 Grade Supported Foundation

We recommend a vapor barrier in the form of a poly vinyl sheet directly beneath the foundation with a minimum 8" thick layer of granular base beneath the vapor barrier and a minimum 3' layer of engineered fill beneath the base or as required to bring the finished floor elevation to design grade. Footings shall bear to a depth of 3' below existing grade or engineered fill shall be provided below the perimeter grade beams to a depth of 3' below existing grade to accommodate the soil modification plan. A depth of 12" shall be utilized for the design frost depth. We recommend the poly vinyl vapor barrier to be a minimum 10 ml thickness. The placement of these materials shall be in accordance with the Site Preparation section of this report. We recommend for the poly vinyl to be installed over a sand bed of approximately 1" thick to minimize tears in the vinyl experienced when installed over a granular base. We recommend installing the vapor barrier in a manner to minimize tears and abrasions to the vinyl. We recommend doing a pre-pour inspection to verify that the vinyl is not torn and if so, that it is taped up and sealed, prior to placement of concrete.

We recommend grade beams not supported by piers to be a minimum of 15" wide, the dimensions of spread footings should be a minimum of 30" on all sides, and all footings properly reinforced for the anticipated design loads to minimize the possibility of a local bearing capacity failure.

Shallow continuous footings used for any portion of the foundation system should be structurally tied to the grade beams, spread footings, piers or other structural elements. We recommend bearing the footings a minimum of 1' below finished grade. The allowable bearing pressure exerted by the grade beams or spread footings on the in-situ soils from a depth of 1' to 2' is 600 psf and from a depth of 2' to 4' is 1,100 psf. The value of 125 pci for subgrade modulus may be used for design purposes. The value of 19 degrees may be utilized for the internal friction angle of the clayey soils for design purposes. The value of 0.35 for the ultimate lateral sliding resistance coefficient may be utilized for design in regard to the foundation on an engineered fill. The allowable bearing pressure exerted by grade beams bearing into an engineered fill, placed in accordance with the specifications in Site Preparation of this report, is 3,500 psf.

4.4.2 Drilled Piers

Floor slabs which have a high-performance criteria and a low tolerance for movement should be structurally suspended on piers. Void cartons should be utilized under grade beams and the slab. The void cartons should be a minimum of 10" thick. If a crawlspace is provided, it should be graded to drain so that water is not permitted to accumulate beneath the floor slab. We recommend to install a vapor barrier for the proposed crawl spaces. We recommend the poly vinyl vapor barrier to be a minimum 10 ml thickness. We do not recommend the use of trapezoidal void forms, due to the varied results of concrete placement typically experienced. Wall loads should be transmitted to the drilled piers by grade beams and the grade beam should be structurally connected to the piers.

Straight shaft piers can be used for foundation support where column loads are less than 50 kips. The piers should bear a minimum of 16' up to 18' below existing grade, bearing into the firm clay. The piers should be located below the active zone and founded on a firm, stable stratum. We recommend foregoing utilizing side shear resistance for the allowable bearing capacity of the piers between 0 and 10 feet of depth. The piers can be designed with an allowable side shear resistance of 200 psf for the portion of shaft extending from a depth of 10' to the depth of the borehole, in addition to the allowable end bearing pressure stated below. An allowable side shear resistance of 150 psf for the portion of shaft extending from a depth of 10' to the depth of the borehole may be utilized for uplift resistance. The allowable lateral bearing of the piers on the clayey soils may be taken as 150 psf/f. Field adjustments to some shafts depths may be required due to the variation in the site elevations and varied soils encountered. The allowable end bearing pressure exerted by the piers on the soils 16' to 18' below existing grade is 3,500 psf.

We do not recommend the use of underreamed piers in the subsurface soil and gravel encountered due to the difficulty of construction. We recommend a minimum and maximum shaft diameter of 24" and 42", respectively for piers. Adjacent piers should maintain a minimum center to center spacing of 3 times the end bearing diameter. Piers spaced as specified do not require a reduction in the load carrying capacity of the individual piers due to group action.

Settlement of properly constructed piers are estimated to be less than ½" for loads of 50 kips or less. Additional settlement may occur if the load exceeds 50 kips.

Piers should be inspected for proper size, depth and reinforcement placement prior to the placement of any concrete. It is essential that the bearing stratum of the piers be identified by the engineer or his representative. A representative from SKG Engineering should be present during drilling activities to approve the bearing strata. Each pier excavation should be completed, and concrete placed within one

day. In no instance should any pier excavation be left open overnight. We recommend alternating the drilling and placement of concrete for shafts in groups. Foundation concrete should be placed in clean, dry holes. Bottoms of pier excavation should be cleared of loose debris prior to the placement of concrete.

We anticipate temporary pier casing will have to be used to prevent caving or sloughing of the hole during pier drilling operations, due to the subsurface stratum. The groundwater encountered will hinder pier installation processes and possibly the pier drilling. The contractor should anticipate utilizing all measures required to install the piers which may include: casing the piers, dewatering the pier excavations by means of pumps and pumping of concrete from the bottom of the pier.

4.4.3 Uplift Loads

The piers may experience negligible tensile loads and will not require reinforcement to accommodate net tensile loads.

4.5 Seismic Design Criteria

We have provided the seismic criteria for use in the structural design phase of the project. The seismic criteria is based on the 2015 International Building Code. The stratum referenced in this section refer to those described in the section Subsurface Materials and Conditions of this report. Please refer to the following table for seismic design parameters.

Mapped Spectral Response Acceleration					
Description	Site Class	Short Periods (S_s)	1 Second Period (S_1)	Site Coefficients	
				F_a	F_v
Stratum I & II	E	0.09g	0.04g	2.5	3.5
Stratum III	C	0.09g	0.04g	1.2	1.7
Stratum IV	D	0.09g	0.04g	1.6	2.4

The International Building Code (IBC) requires a site soil profile determination extending a depth of 100 feet for seismic site classification. The scope of our geotechnical services requested does not include the 100 foot soil profile determination. Additional services can be performed if requested or required, since our scope terminated the boreholes at a depth of 20 feet. We would recommend utilizing a Seismic Site Classification of D for this site, based on the soil conditions to a depth of 20 feet.

4.6 Lateral Design Criteria

Retaining walls that are sensitive to movements on the order of 1-½" should be supported by piers bearing a minimum of 15' below existing grade in a firm stable stratum. We recommend that wall footings bear a minimum of 2' below finished grade and be designed to withstand the lateral forces applied by earth pressures described below. The footings should not exceed the allowable bearing capacity of the soil on which it bears. The allowable passive earth pressure is 176 psf/ft of the depth, to a maximum of 1,500 psf.

Lateral earth pressures acting on the retaining walls will depend on several parameters such as; backfill used, drainage conditions and loads of adjacent structures. Recommended lateral earth pressures expressed as equivalent fluid pressures are presented below. The pressures below are assuming positive drainage is provided to prevent hydrostatic pressures.

Equivalent Fluid Pressures		
Material	At Rest (psf/ft)	Active (psf/ft)
Stratum I	-	-
Stratum II, III, & IV	100	60
Engineered Fill	60	30

4.7 Backfill Material and Compaction

Retaining walls should be backfilled with a 12" width of pea gravel for the height of the wall. Backfill behind the pea gravel should be a non-expansive fill material with a maximum particle size of 4" nominal diameter three quarters of the wall height and a clay cap on the top quarter of the wall height. We recommend providing weep holes along the bottom of the retaining wall height at 10' on center maximum spacing for the length of the wall. We recommend placing fill in maximum 8" loose lifts and compacted to between 93% to 97% of the Standard Proctor Density. Compaction tests should be performed on each lift.

4.8 Drainage

Positive drainage away from the foundation must be provided and maintained to reduce subsurface moisture variations. The minimum recommended slope away from the foundation is 5% for the first 10 feet for areas not covered by a sidewalk or pavement. Water shall not be permitted to pond on the finished site.

Due to the presence of in-situ clays, we recommend through the design and construction phase an emphasis on maintaining a stable moisture content in the soils beneath and adjacent to the foundation be a major priority. Temporary and permanent control measures should be properly designed and installed to ensure positive drainage away from the foundation to maintain a quasi stable soil moisture content. The measures include, but are not limited to gutters, sprinkler systems, and a site grading plan.

4.9 Underground Utilities

The backfill material used for underground utility trenches should be on-site materials or imported clayey materials. We recommend not using a granular material to avoid the possibility of water migration through the trenches and possibly under foundation systems at the site.

4.10 Exterior Flatwork Considerations

Continuous flatwork in the form of sidewalks that overlie clayey soils should have a perimeter stem bearing a minimum of 6" below grade and a minimum 10" overall depth. Engineered fill shall be used if fill is needed to bring the flatwork to grade. Control joints should be cut at a maximum spacing of 6' for the length of the flatwork. We recommend installing flatwork as not to impound water adjacent to structural foundations.

The connection of proposed flatwork at the site and the foundation system will have the potential for differential movement, if it is not supported in the same manner as the foundation. The owner and architect will have to determine their tolerance and the associated project budget for the potential movement considerations. Based on the owner's tolerance for movement, the structural engineer may choose to provide some structural flatwork or soil replacement beneath the flatwork for a distance away from the connection of the flatwork to the building slabs, to allow for potential movement to occur some distance away from the entrances to the buildings.

4.11 Trenching and Excavation Requirements

The guidelines specified by Occupational Safety and Health Administration (OSHA) should be followed for all excavation activities. The OSHA Standards (29 CFR Part 1926 revised, 1989) require all trenches that exceed 5' in depth to be shored or benched appropriately unless the soil stratum is "solid" rock.

The OSHA standards should be strictly adhered to for all excavation activities. The classification of the soils encountered at the site are Type B soils. The soil classifications are based on soils encountered in the boreholes conducted at the site. Refer to the following OSHA Table B-1 for slope requirements for excavations that are less than 20 feet in depth. Trenches in excess of 20 feet in depth should be designed by a registered professional engineer.

Maximum Allowable Slopes		
Stratum	Horizontal	Vertical
Stable Rock	Vertical	1
Type A	3/4	1
Type B	1	1
Type C	1-1/2	1

The above information is provided for temporary excavations. We recommend that any permanent trenches proposed for the site should have a minimum of 4:1 side slopes. Any permanent trenches or channels should be lined with erosion control measures.

5.0 Site Preparation

5.1 Subgrade

Remove the top 6" of surface soils, any deleterious material, and in-situ soils as necessary to bring the finished floor elevation to design grade. The top 6" of material should then be scarified, moisture conditioned, and compacted to at least 95% of the Standard Proctor Density within 2% points of the optimum moisture content. Any soft or pumping areas are to be excavated and an engineered fill shall be used as backfill. Where existing slopes exceed ten horizontal to one vertical, the cross slope should be benched to provide a minimum of 6' bench width.

5.2 Engineered Fill

An approved select fill shall be used to bring the foundation system to grade. It shall be a non-granular, cohesive soil, free of deleterious material, have a liquid limit of less than 40, and a plasticity index between 6 and 14. The select fill shall meet the following percent retained on sieve requirements: 2-1/2": 0-5%, No. 4: 40-80%, and No. 40: 50-85% or obtain approval from the geotechnical engineer. The fill should be installed in maximum eight inch loose lifts and compacted to at least 95% of the Standard Proctor Density within 3% points of the optimum moisture content. Base consisting of TxDOT Type A, Grade 2 limestone will be accepted as engineered fill. Blended materials utilized for engineered fill will have to meet the specifications herein and be approved by the geotechnical engineer. If a blended material is approved, the contractor shall blend the material and have one stockpile for the entire project. Continuous blending of material throughout the duration of the project is not acceptable.

5.3 Flexible Base Material

Provide compacted base consisting of Type A, Grade 2, limestone material below the foundation. Compact to 96% of the Standard Proctor Density within 2% points of the optimum moisture content. Material shall be placed in lifts not to exceed 8". Alternative flexible base materials provided by a local suppliers which do not meet theses specifications shall be approved by the Engineer of record.

5.4 Testing

Test results of the engineered fill shall be submitted to the engineer of record for approval prior to incorporating into the work. Arrange for a testing agency to verify flexible base, engineered fill, and subgrade compaction and moisture content. To confirm the compaction of the subgrade, engineered fill, and base we recommend the more stringent of three density test for each lift placed or one density test for every 2,000 square feet of foundation area for each lift placed. The Standard Proctor Density shall be determined in accordance with ASTM D698.

6.0 Pavement Design and Criteria

6.1 Considerations

Concrete or asphalt paving may be used to surface the area for access and parking. Concrete paving is recommended at entrances and areas that will be subject to truck and dumpster traffic. The pavements may be subject to slight differential movement due to underlying clays. Pavement grades should be greater than 1.0% and curb and gutter grades should be greater than 0.4%. Positive drainage shall be provided to prevent water from ponding.

"Light and Medium Duty" pavement is intended for parking areas and other lightly traveled areas. "Heavy Duty" pavement is intended for drives, loading areas, and highly used areas subject to heavier traffic loads. Light, medium, and heavy duty pavement sections were evaluated using procedures from the AASHTO Guide for Design of Pavement Structures. Assumptions used in the design include: a serviceability loss of 2.5, a 90% reliability, a standard deviation of 0.40%, and a soil resilient modulus of 8,000 psi. Traffic design values used for this report are: 50,000 ESALs for light duty, 100,000 ESALs for medium duty, and 200,000 ESALs for heavy duty pavement. In the event site specific traffic conditions vary from these design values, contact the engineer of record for supplemental pavement designs.

6.2 Asphalt Pavement

Areas to receive asphalt pavement should have the top 6" of surface soils and any deleterious material removed, cut to subgrade elevation, and then proof rolled. Any soft spots found during the proof rolling should be removed and filled back to grade. The top six inches of subgrade should be scarified and compacted to at least 95% Standard Proctor Density within 2% points of the optimum moisture content. At the contractor's option, 6% to 12% lime may be added to the subgrade during the scarifying process to stabilize soil and possibly achieve compaction with less effort and pumping of the clayey soils. Where additional fill is required, an engineered fill placed in accordance with the Engineered Fill section of this report may be used. The flexible base shall be compacted to at least 97% Standard Proctor Density. The Hot Mix Asphalt Concrete (HMAC) shall be Type D or C dense graded hot-mix asphalt meeting the requirements of TxDOT Item 341. HMAC base shall be Type A or B dense graded hot-mix asphalt meeting the requirements of TxDOT Item 341. The pavement schedule below provides options for the pavement sections based on different ESAL levels.

HMAC over Granular Base			
Pavement Component	Traffic Design ESALs		
	50,000	100,000	200,000
	Thickness (inches)		
HMAC (A_1=0.44)	1.50	2.00	2.25
Crushed Stone Base (A_2=0.18)	7.50	7.50	8.50
Compacted Subgrade	6.00	6.00	6.00

Full Depth HMAC			
Pavement Component	Traffic Design ESALs		
	50,000	100,000	200,000
	Thickness (inches)		
HMAC (A_1=0.44)	1.50	2.00	2.25
HMAC Base (A_2=0.35)	4.00	4.00	4.50
Compacted Subgrade	6.00	6.00	6.00

6.3 Concrete Pavement

Areas to receive concrete paving should have the top 6" of surface soil, any deleterious material removed, cut to subgrade elevation, and then proof rolled. Any soft spots found during the proof rolling should be removed and filled back to grade. The top six inches of subgrade should be scarified and compacted to at least 95% Standard Proctor Density. At the contractor's option, 6% to 12% lime may be added to the subgrade during the scarifying process to stabilize soil and possibly achieve compaction with less effort and pumping of the clayey soils. Where additional fill is required, an engineered fill placed in accordance with the ENGINEERED FILL section of this report may be used. The concrete shall have a minimum 28 day compressive strength of 3,000 psi and an air content between 3 and 6%. Light and Medium duty concrete pavement shall be reinforced with #4 bars at 24" centers each way, at a minimum. Heavy duty concrete pavement shall be reinforced with a minimum #4 bars at 18" centers each way. It is recommended that #4 bars at 12" centers each way be used in the area where the front wheels of the trash truck stop in front of the dumpster that may be located on the site. Saw cut control joints to one fourth of the total depth at a spacing not to exceed 15' each direction. Provide expansion/contraction joints at a spacing not to exceed 60' each direction.

Concrete over Subgrade			
Pavement Component	Traffic Design ESALs		
	50,000	100,000	200,000
	Thickness (inches)		
Concrete	4.50	5.00	6.00
Compacted Subgrade	6.00	6.00	6.00

6.4 Flexible Base Material

Base materials to be utilized within the paved areas should be a crushed limestone meeting the requirements of TxDOT Item 247, Type A, Grade 2, thus having a Plasticity Index less than or equal to 12 and a Liquid Limit less than or equal to 40. The base materials should be placed in loose lifts with a compacted thickness not to exceed 8 inches per lift. Alternative flexible base materials provided by a local suppliers which do not meet theses specifications shall be approved by the Engineer of record.

7.0 Limitations

The recommendations presented in this report are based upon the information obtained from the borings performed at the site and from other information discussed in this report. This report is based upon the findings from the borings made and may not identify all subsurface variations which exist across the site. The nature and extent of such variations may not become evident until construction. If significant variations appear, contact SKG Engineering to further access the design criteria and the recommendations contained within this report.

The scope of services for this project does not include either specifically or by implication any environmental assessment of the site or identification of contaminated or hazardous materials or conditions. If the owner is concerned about the potential for such conditions, the appropriate investigations should be performed.

No warranties, either expressed or implied, are intended or made. In the event that changes in the nature, design, or location of the project as outlined in this report are made, the recommendations contained in this report shall not be considered valid unless SKG Engineering reviews the changes and either verifies or modifies the conclusions of this report in writing.

Attachment A

Field Conditions

Summary of Field Conditions

The following field conditions were observed during the field exploration activities.

1. The site is developed with the current school facilities. The accessibility of some types of equipment should be verified in some of the areas of the site where multiple buildings are in the area.

2. The surface soil conditions on the site are generally clay that is considered a soft soil material. The soil conditions will probably prove to hinder mobilization of some types of construction equipment during rain events that saturate the soils.

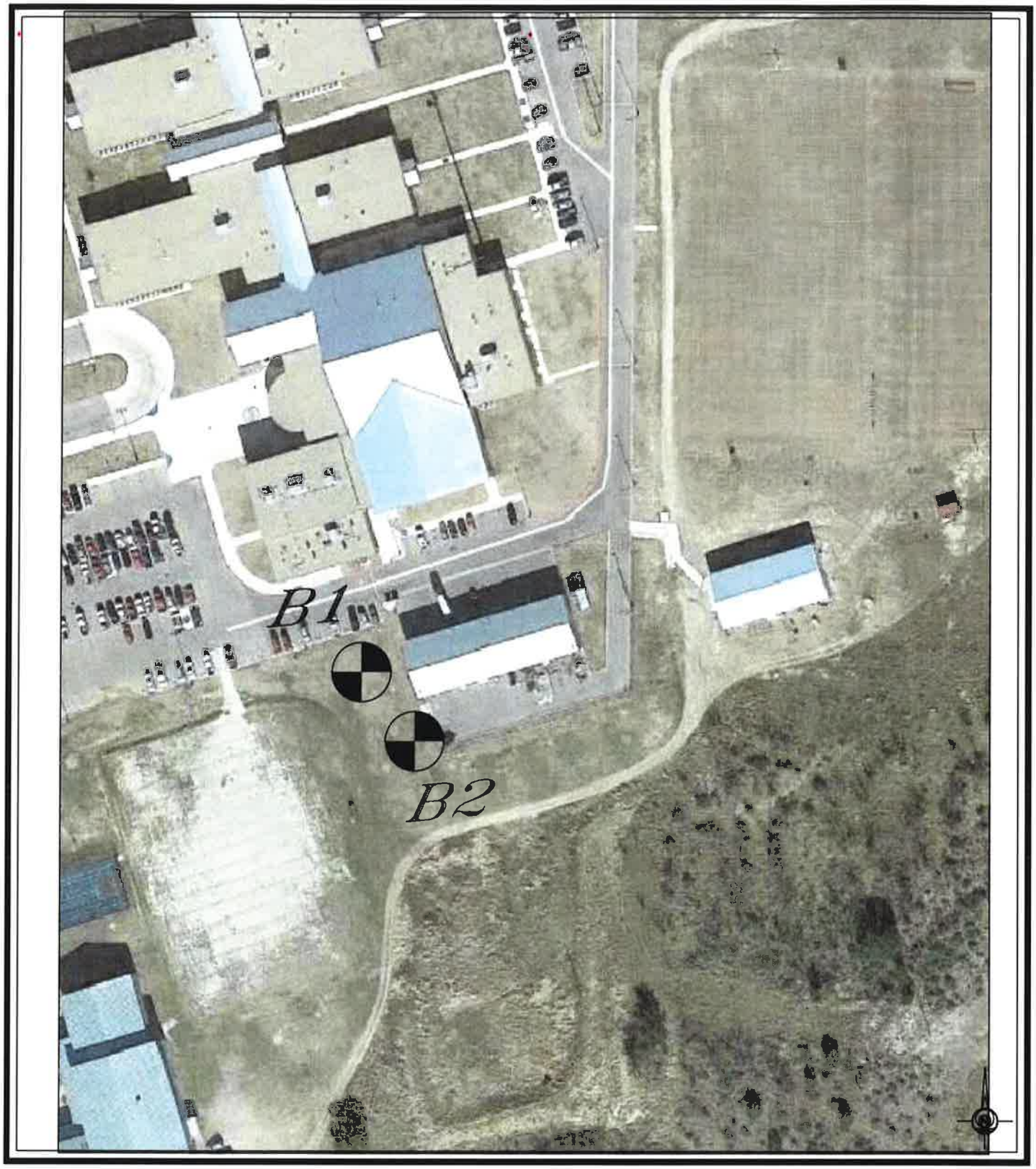
3. Groundwater was present at the time of drilling activities. Refer to the logs of boreholes for specific water levels.

4. No rock was encountered in any of the boreholes conducted at the site.

5. Site soils are not anticipated to be of quality to be used for fill material under the foundation systems. We anticipate the site soils may be used for nonstructural applications, such as; landscape fill.

Attachment B

Borehole Location Map



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Brady ISD
Proposed Career Cener
Brady, Texas

BOREHOLE LOCATION MAP

DWG BY: EO	DWG. DATE: 2.15.2019
JOB NO. 19-E-0129	SHEET NO. BH1
SCALE: N.T.S.	

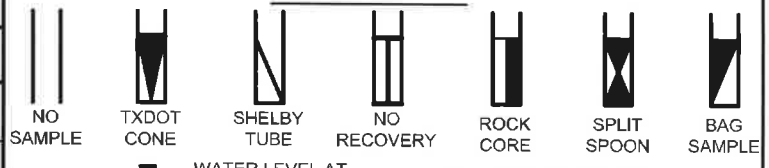
Attachment C

Logs of Boreholes

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISION			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE.	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL GRADED GRAVELS, GRAVEL–SAND MIXTURES, LITTLE OR NO FINES.
				GP	POORLY GRADED GRAVELS OR GRAVEL–SAND MIXTURES, LITTLE OR NO FINES.
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL–SAND–SILT MIXTURES.
				GC	CLAYEY GRAVELS, GRAVEL–SAND–SILT MIXTURES.
	SILTS AND CLAYS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES.
				SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES.
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND–SILT MIXTURES.
				SC	CLAYEY SANDS, SAND–CLAY MIXTURES.
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE.	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50.			ML	INORGANIC SILTS AND VERY FINE SANDS, FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS AND WITH SLIGHT PLASTICITY.
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS.
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY.
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50.			MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS.
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS.
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS.
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS.

SAMPLER TYPE



SOIL TERMS	DESCRIPTION
BLOCKY	CONTAINS CRACKS OR FAILURE PLANES RESULTING IN ROUGH CUBES OF MATERIAL.
CALCAREOUS	CONTAINS APPRECIABLE QUANTITIES OF CALCIUM CARBONATE.
FISSURED	CONTAINS SHRINKAGE CRACKS, WHICH ARE FREQUENTLY FILLED WITH FINE SAND OR SILT. THE FISSURES ARE USUALLY NEAR VERTICAL IN ORIENTATION.
INTERBEDDED	COMPOSED OF ALTERNATING LAYERS OF DIFFERENT SOIL TYPES.
LAMINATED	COMPOSED OF THIN LAYERS OF VARYING COLOR AND TEXTURE.
NODULES	SECONDARY INCLUSIONS THAT APPEAR AS SMALL LUMPS ABOUT 0.1 TO 0.3 INCH IN DIAMETER.
PARTINGS	INCLUSION OF DIFFERENT MATERIAL LESS THAN ⅛ INCH THICK EXTENDING THROUGH THE SAMPLE.
POCKETS	INCLUSION OF DIFFERENT MATERIAL THAT IS SMALLER THAN THE DIAMETER OF THE SAMPLE.
SEAMS	INCLUSION OF DIFFERENT MATERIAL BETWEEN ⅛ AND 3 INCHES THICK, AND EXTENDS THROUGH THE SAMPLE.
SLICKENSIDED	HAS INCLINED PLANES OF WEAKNESS THAT ARE SLICK AND GLOSSY IN APPEARANCE. SLICKENSIDES ARE COMMONLY THOUGHT TO BE RANDOMLY ORIENTED.
STREAKS OR STAINS	STAINS OF LIMITED EXTENT THAT APPEAR AS SHORT STRIPES, SPOTS OR BLOTCHES.

ROCK TERMS	
BEDDING PLANE	A SURFACE PARALLEL TO THE SURFACE OF DEPOSITION, GENERALLY MARKED BY CHANGES IN COLOR OR GRAIN SIZE.
FRACTURE	A NATURAL BREAK IN ROCK ALONG WHICH NO DISPLACEMENT HAS OCCURED.
JOINT	A NATURAL BREAK ALONG WHICH NO DISPLACEMENT HAS OCCURED, WHICH GENERALLY INTERSECTS PRIMARY SURFACES.
% RECOVERY	THE RATIO OF TOTAL LENGTH OF RECOVERY TO THE TOTAL LENGTH OF CORE RUN, EXPRESSED AS A PERCENTAGE.
RQD - ROCK QUALITY DESIGNATION	THE RATIO OF TOTAL RECOVERED LENGTH OF FRAGMENTS LONGER THAN 4 INCHES TO THE TOTAL RUN LENGTH, EXPRESSED AS A PERCENTAGE.
WEATHERING	THE PROCESS BY WHICH ROCK IS BROKEN DOWN AND DECOMPOSED.

MOISTURE CONTENT

DRY	ABSENCE OF MOISTURE, DUSTY, DRY TO THE TOUCH.
DAMP	SOME PERCEPTIBLE MOISTURE; BELOW OPTIMUM.
MOIST	NO VISIBLE WATER; NEAR OPTIMUM MOISTURE CONTENT.
WET	VISIBLE FREE WATER, USUALLY SOIL IS BELOW WATER TABLE.

CONSISTENCY OF COHESIVE SOILS

CONSISTENCY	POCKET PENETROMETER READING IN TONS/FT2	N-VALUE (BLOWS/FOOT)
VERY SOFT	0 TO 0.25	<2
SOFT	0.25 TO 0.5	2 TO 4
FIRM	0.5 TO 1.0	4 TO 8
STIFF	1.0 TO 2.0	8 TO 15
VERY STIFF	2.0 TO 4.0	15 TO 30
HARD	>4.0 OR 4.5+	>30

CLAY	SILT	SAND			GRAVEL		COBBLES	BOULDERS
		FINE	MEDIUM	COARSE	FINE	COARSE		

0.005mm No.200 No.40 No.10 No.4 ¾" 3" 12"

U.S. STANDARD SIEVE SIZE

RELATIVE DENSITY-GRANULAR SOILS

CONSISTENCY	N-VALUE (BLOWS/FOOT)
VERY LOOSE	0 TO 4
LOOSE	5 TO 10
MEDIUM DENSE	11 TO 30
DENSE	31 TO 50
VERY DENSE	>50 OR 50+

REFERENCE: THE UNIFIED SOIL CLASSIFICATION SYSTEM, CORPS OF ENGINEERS, U.S. ARMY TECHNICAL MEMORANDUM NO. 3–357, VOL. 1 MARCH, 1953 (REVISED APRIL, 1960)

KEY
TO SYMBOLS AND TERMS

SKG
ENGINEERING

Project: Proposed Career Center Brady, Texas	B1

Boring Location: Refer to the borehole location map

Date Started: January 30, 2019 | Date Finished: January 30, 2019

Drilling Method: Air rotary

Hammer Weight: 140 lbs | Drop: 30 inches

Sampler: Shelby tube/2" split barrel sampler

Surface Elevation:

Depth (feet)	Lith-ology	Material Description	Samples: Number	Samples: Type	Samples: SPT	Laboratory: M%	Laboratory: PI	Laboratory: Pen (tsf)
0		fat CLAY (CH); brown, with sand			3/4/3			
					4/3/5	22.7	32	
5					4/4/6			
		lean CLAY (CL); red						
10					6/6/5	21.8	16	
		clayey SAND (SC); tan, with gravel						
15		cemented seam from approximately 13' - 15'			50-0"			
		sandy lean CLAY (CL); tan						
20					16/20/21	7.1	20	
		Boring completed at a depth of 20'. Groundwater was present at approximately 18' below existing grade at the time of drilling activites.						
25								
30								
35								

SKG Engineering, LLC | 19-E-0129 | Plate A-1

Project:	B2
Proposed Career Center **Brady, Texas**	

Boring Location: Refer to the borehole location map

Date Started: January 30, 2019 | **Date Finished:** January 30, 2019

Drilling Method: Air rotary

Hammer Weight: 140 lbs | **Drop:** 30 inches

Sampler: Shelby tube/2" split barrel sampler

Surface Elevation:

Depth (feet)	Lith-ology	Material Description	Samples: Number	Samples: Type	Samples: SPT	Laboratory: M%	Laboratory: PI	Laboratory: Pen (tsf)
0		sandy lean CLAY (CL); brown			5/7/6	17.3	23	
		fat CLAY (CH); brown, with sand			3/3/3			
5					4/5/15	23.4	31	
		lean CLAY (CL); red						
10					9/6/9			
		clayey SAND (SC); tan, with gravel Very heavy seam of gravel at approximately 15' - 17'			50-6"	6.9	10	
15		sandy lean CLAY (CL); tan						
20					13/17/15			

Boring completed at a depth of 20'. Groundwater was present at approximately 17' below existing grade at the time of drilling activites.

25

30

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Attachment D

Laboratory Results

SKG
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ANALYSIS RESULTS

CLIENT: Brady ISD
PROJECT: Proposed Career Center
PROJECT #: 19-E-0129
DATE: 2/15/2019

Lab No.	Description	Plastic Limit (%) *	Liquid Limit (%)*	Plasticity Index *	Moisture (%) *	Pass # 4 Sieve (%)*	Pass # 40 Sieve (%)*	Pass # 200 Sieve (%)*
0069	B1 1.5' 3'	22	53	32	22.7	96.0	88.7	83.2
0070	B1 8.5' 10'	13	32	16	21.8	99.8	96.0	93.5
0071	B1 18.5' 20'	14	34	20	7.1	88.2	55.1	50.0
0072	B2 0' 1.5'	22	44	23	17.3	88.4	73.4	63.0
0073	B2 3.5' 5'	19	50	31	23.4	93.8	82.6	76.4
0074	B2 13.5' 15'	12	22	10	6.9	61.4	33.4	25.4

Average PL	17
Average LL	39
Average PI	22
Average % Clay	65.3

Stephanie Cheatheam

Stephanie Cheatheam
Lab/CMT Manager