PROJECT MANUAL / SPECIFICATIONS

Document Issue Date: March 30th, 2018

USD 320 Wamego- Phase 3, Bid Package 2, Wamego High School Remodel: Food Service, Structural, Doors, Glass, MEP, Lockers

Location of Project: 801 Lincoln Ave., Wamego, KS, 66547

Bid Due Date: April 13th, 2018 at 2:00 PM CST (unless modified by addendum)

Owner: USD 320 Wamego, 1008 8th St., Wamego, KS 66547

Architect: BBN Architects Inc., 228 Poyntz Avenue, Manhattan, KS 66502

CMAR: Coonrod & Associates Construction Co., Inc., 3550 S. Hoover Rd., Wichita, KS, 67215

USD 320 Wamego- PH3 BP2-Wamego High School Remodel: Food Service, Structural, Doors, Glass, MEP, Lockers

INSTRUCTIONS TO BIDDERS

Date: 3/30/2018

Construction Manager:	Brad Rice, Project Manager	Coonrod & Associates	bradr@coonrod.com	P: 316-942-8430
	Scot Wolfington, Project Lead	Coonrod & Associates		
	Jack Austin, Steve Austin- Superintendents	Coonrod & Associates		
	Niki Parks, Assistant to PM's	Coonrod & Associates	nikip@coonrod.com	P: 316-942-8430
Architect:	Dan Crouch	BBN Architects Inc.		
	Carl Riblett	BBN Architects Inc.		

	Bid Date	**Time**
USD 320 Wamego- PH3 BP2-Wamego High School Remodel: Food Service, Structural, Doors, Glass, MEP, Lockers	**4/13/2018**	**2:00:00 PM, CST**

Bidding Procedures

Public bid opening- Base bid prices will be read aloud.

Non-Mandatory Pre-Bid / Walk Through: **4/4/2018** **3:30 PM, CST**

- Pre Bid Location: Wamego High School, 801 Lincoln Ave, Wamego, KS. Meeting will be located in the library conference meeting room. Please enter the school at the main entry on the east side, library is located at the top of the stairs after you enter.

Bids can be turned in at: USD 320 District Office, 1008 8th St., Wamego, KS, 66547, PLC Room.

Faxed Bids are acceptable. Please send to the fax number **785-456-1690**

Emailed bids are acceptable. Please email to **nikip@coonrod.com**.

FAXED OR EMAILED BIDS MUST RECEIVE VERBAL OR EMAIL ACKNOWLEDGEMENT OF RECEIPT - CALL 316-942-8430

The owner, architect and construction manager will review the bids and determine the lowest, reponsible bidder. The owner, architect and/or the construction manager reserve the right to reject any and/or all bids.

Late bids will not be considered.

Please use bid form provided. To be added by addendum.

There will be a bid scope sheet issued by addendum. Please review and bid accordingly.

Plans

www.gradebeam.com

http://www.coonrod.com/wamego/

Kansas Construction News Report- Wichita, KS

****Addenda only sent to bidders receiving plans from Gradebeam**

Review the specification sections and plans carefully. Bid package 2 (BP2) is for certain parts of this project only. Make sure you are bidding the correct specification.

The plans issued are for the entire Phase 3 project. The specifications are for BID PACKAGE 2 (BP2) ONLY.

Bonding

Successful subcontract bidders over $100,000 require Perf. & Payment Bonds

Include the price of the bid bond and P&P bond in the bid

Sales Tax

Exempt

Alternates:

None- Unless added by Addendum.

Unit Prices:

None- Unless added by Addendum.

Schedule

Schedule is part of the specifications.

Liquidated damages = $500 / calendar day past substantial completion.

Working days / hours will be 5 days, 8 hours each, 7:00 AM - 3:30 PM.

Overtime costs, (weekends, before 7:00 AM or after 3:30 PM), needs to be included in your bid to meet the schedule included in specifications.

Testing & Special Inspections Per plans / specifications

Submittals Via Submittal Exchange

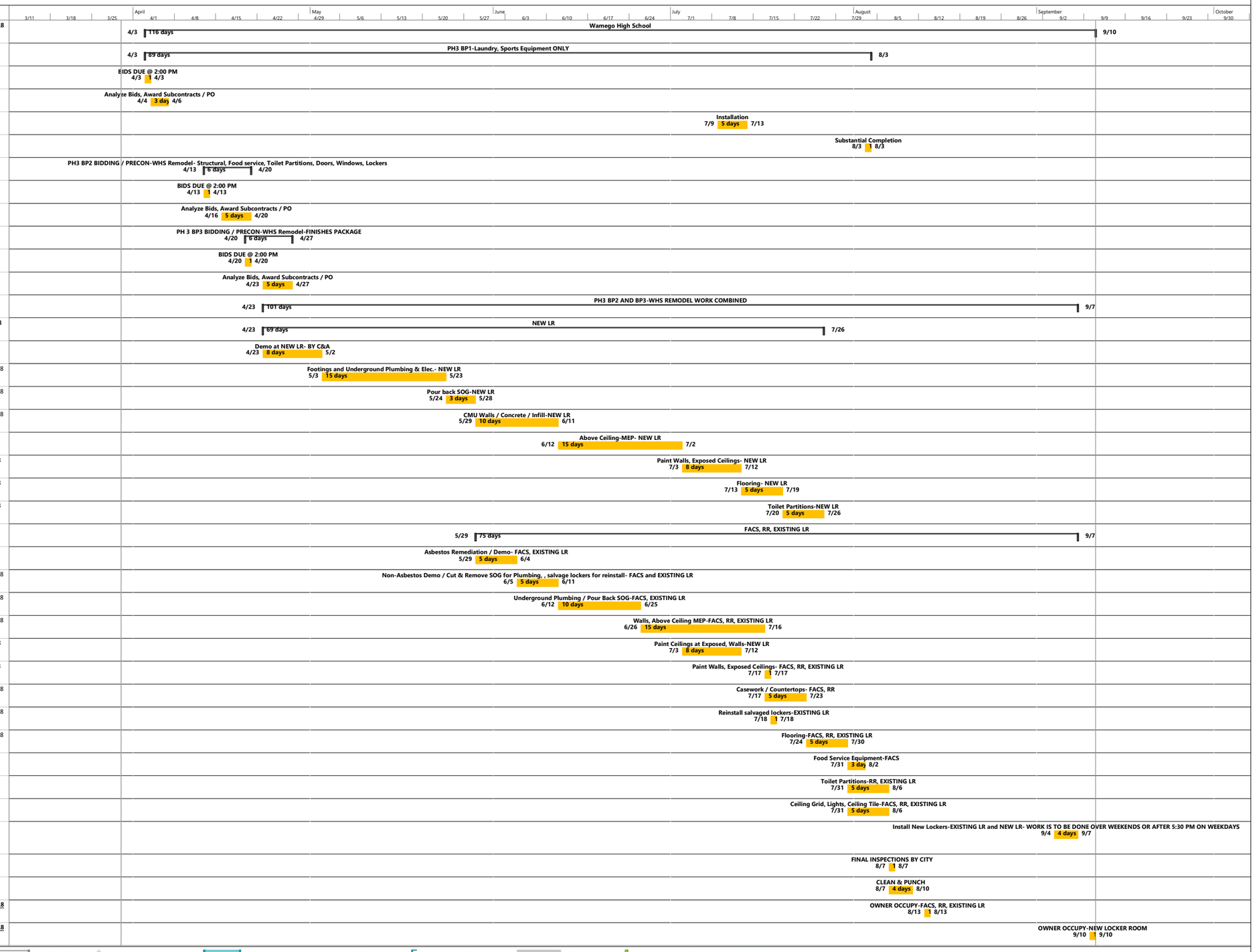
Misc. Items

1. ALL questions/RFI's pre-bid and during construction must be sent in writing. Please send to bradr@coonrod.com.
2. All subs/suppliers are responsible for having material delivered on time and have crews ready to go per the CM's schedule. There will be no added compensation for overtime work only unless there are circumstances out of the subcontractor's/supplier's control. Each subcontractor is required to provide enough manpower to meet the schedule and your bid should reflect this accordingly. **Each subcontractor / supplier is to make sure that materials can and will arrive on time per the schedule BEFORE BIDDING.** There will be no added compensation after the bid for accelerating the delivery time.

USD 320-PHASE 3, BID PACKAGES 1-3- WAMEGO HIGH SCHOOL- SUMMER 2018

COONROD ASSOCIATES

ID	Task Mode	Task Name	Duration	Start	Finish
1		**Wamego High School**	**116 days**	**Tue 4/3/18**	**Mon 9/10/18**
2		**PH3 BP1-Laundry, Sports Equipment ONLY**	**89 days**	**Tue 4/3/18**	**Fri 8/3/18**
3		BIDS DUE @ 2:00 PM	1 day	Tue 4/3/18	Tue 4/3/18
4		Analyze Bids, Award Subcontracts / PO	3 days	Wed 4/4/18	Fri 4/6/18
5		Installation	5 days	Mon 7/9/18	Fri 7/13/18
6		Substantial Completion	1 day	Fri 8/3/18	Fri 8/3/18
10		**PH3 BP2 BIDDING / PRECON-WHS Remodel- Structural, Food service, Toilet Partitions, Doors, Windows, Lockers**	**6 days**	**Fri 4/13/18**	**Fri 4/20/18**
11		BIDS DUE @ 2:00 PM	1 day	Fri 4/13/18	Fri 4/13/18
12		Analyze Bids, Award Subcontracts / PO	5 days	Mon 4/16/18	Fri 4/20/18
7		**PH 3 BP3 BIDDING / PRECON-WHS Remodel-FINISHES PACKAGE**	**6 days**	**Fri 4/20/18**	**Fri 4/27/18**
8		BIDS DUE @ 2:00 PM	1 day	Fri 4/20/18	Fri 4/20/18
9		Analyze Bids, Award Subcontracts / PO	5 days	Mon 4/23/18	Fri 4/27/18
13		**PH3 BP2 AND BP3-WHS REMODEL WORK COMBINED**	**101 days**	**Mon 4/23/18**	**Fri 9/7/18**
28		**NEW LR**	**69 days**	**Mon 4/23/18**	**Thu 7/26/18**
30		Demo at NEW LR- BY C&A	8 days	Mon 4/23/18	Wed 5/2/18
31		Footings and Underground Plumbing & Elec.- NEW LR	15 days	Thu 5/3/18	Wed 5/23/18
33		Pour back SOG-NEW LR	3 days	Thu 5/24/18	Mon 5/28/18
32		CMU Walls / Concrete / Infill-NEW LR	10 days	Tue 5/29/18	Mon 6/11/18
35		Above Ceiling-MEP- NEW LR	15 days	Tue 6/12/18	Mon 7/2/18
29		Paint Walls, Exposed Ceilings- NEW LR	8 days	Tue 7/3/18	Thu 7/12/18
34		Flooring- NEW LR	5 days	Fri 7/13/18	Thu 7/19/18
36		Toilet Partitions-NEW LR	5 days	Fri 7/20/18	Thu 7/26/18
14		**FACS, RR, EXISTING LR**	**75 days**	**Tue 5/29/18**	**Fri 9/7/18**
15		Asbestos Remediation / Demo- FACS, EXISTING LR	5 days	Tue 5/29/18	Mon 6/4/18
16		Non-Asbestos Demo / Cut & Remove SOG for Plumbing, , salvage lockers for reinstall- FACS and EXISTING LR	5 days	Tue 6/5/18	Mon 6/11/18
18		Underground Plumbing / Pour Back SOG-FACS, EXISTING LR	10 days	Tue 6/12/18	Mon 6/25/18
19		Walls, Above Ceiling MEP-FACS, RR, EXISTING LR	15 days	Tue 6/26/18	Mon 7/16/18
17		Paint Ceilings at Exposed, Walls-NEW LR	8 days	Tue 7/3/18	Thu 7/12/18
20		Paint Walls, Exposed Ceilings- FACS, RR, EXISTING LR	1 day	Tue 7/17/18	Tue 7/17/18
21		Casework / Countertops- FACS, RR	5 days	Tue 7/17/18	Mon 7/23/18
25		Reinstall salvaged lockers-EXISTING LR	1 day	Wed 7/18/18	Wed 7/18/18
23		Flooring-FACS, RR, EXISTING LR	5 days	Tue 7/24/18	Mon 7/30/18
22		Food Service Equipment-FACS	3 days	Tue 7/31/18	Thu 8/2/18
24		Toilet Partitions-RR, EXISTING LR	5 days	Tue 7/31/18	Mon 8/6/18
27		Ceiling Grid, Lights, Ceiling Tile-FACS, RR, EXISTING LR	5 days	Tue 7/31/18	Mon 8/6/18
26		Install New Lockers-EXISTING LR and NEW LR- WORK IS TO BE DONE OVER WEEKENDS OR AFTER 5:30 PM ON WEEKDAYS	4 days	Tue 9/4/18	Fri 9/7/18
38		**FINAL INSPECTIONS BY CITY**	**1 day**	**Tue 8/7/18**	**Tue 8/7/18**
39		**CLEAN & PUNCH**	**4 days**	**Tue 8/7/18**	**Fri 8/10/18**
40		**OWNER OCCUPY-FACS, RR, EXISTING LR**	**1 day**	**Mon 8/13/18**	**Mon 8/13/18**
37		**OWNER OCCUPY-NEW LOCKER ROOM**	**1 day**	**Mon 9/10/18**	**Mon 9/10/18**



Project: Schedule- PHASE 3
Date: Fri 3/30/18

Task · Split · Milestone · Summary · Project Summary · Inactive Task · Inactive Milestone · Inactive Summary · Manual Task · Duration-only · Manual Summary Rollup · Manual Summary · Start-only · Finish-only · External Tasks · External Milestone · Deadline · Progress · Manual Progress

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SECTION 00 26 00 - PROCUREMENT SUBSTITUTION PROCEDURES

1.1 DEFINITIONS

A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.

B. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 01 25 00 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

1.2 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.3 PROCUREMENT SUBSTITUTIONS

A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.

B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action:

1. Extensive revisions to the Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
3. The request is fully documented and properly submitted.

1.4 SUBMITTALS

A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing by prime contract Bidder only in compliance with the following requirements:

1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
2. Submittal Format: Submit three copies of each written Procurement Substitution Request, using form bound in Project Manual after Section 01 25 00 "Substitution Procedures."

a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:

1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
2) Copies of current, independent third-party test data of salient product or system characteristics.
3) Samples where applicable or when requested by Architect.
4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
6) Research reports evidencing compliance with building code in effect for Project, from ICC-ES or from code organization acceptable to Owner.
7) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.

c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.
d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

B. Architect's Action:

1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

C. Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF SECTON 00 26 00

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Coordination with occupants.
5. Work restrictions.
6. Specification and drawing conventions.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: USD 320 Wamego School District Improvements.

1. Project Locations:

a. Central Elementary School, 900 7th Street, Wamego, KS 66547
b. West Elementary School, 1911 Sixth Street, Wamego, KS 66547
c. Wamego Middle School, 1701 Kaw Valley Road, Wamego, KS 66547
d. Wamego High School, 801 Lincoln, Wamego, KS 66547
e. Wamego Sports Complex-Highway 24 and Columbian Rd.
f. Wamego Facilities and Bus Operations, 4290 Columbian Rd.
g. District Office

B. Owner: USD 320 Wamego School District, 1008 8th Street, Wamego, KS 66547.

1. Representative: Tim Winter, Superintendent.

C. Architect: BBN Architects Inc., 228 Poyntz Avenue, Manhattan, KS 66502.

1. Representative: Dan Crouch; dlc@bbnarchitects.com

D. Construction Manager at Risk: Coonrod and Associates Construction Company, Inc., 3550 S Hoover Rd, Wichita, KS 67215.

1. Representative: Brad Rice.
2. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Renovation of existing facilities and construction of construction of new facilities.

B. Type of Contract: Project will be constructed under a single contract with the Construction Manager at Risk.

1.5 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways, parking areas, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.6 COORDINATION WITH OCCUPANTS

A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.

2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.7 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: 7:00 a.m. to 5:00 p.m., with Owner’s written permission.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions indicating specific times of the interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than two days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

E. Restricted Substances: Use of tobacco products and other controlled substances within the existing building or on Project site is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 01 26 00 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Section 01 40 00 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES (EXAMPLES)

A. Unit Price No. 1: Removal of unsatisfactory soil and replacement with satisfactory soil material.

1. Description: Unsatisfactory soil excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, according to Section 31 20 00 "Earth Moving."
2. Unit of Measurement: Cubic yard (Cubic meter) of soil excavated, based on in-place surveys of volume before and after removal.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 01 21 00 "Allowances."

B. Unit Price No. 2: Rock excavation and replacement with satisfactory soil material.

1. Description: Classified rock excavation and disposal off-site and replacement with satisfactory fill material or engineered fill from off-site, as required, according to Section 31 20 00 "Earth Moving."
2. Unit of Measurement: Cubic yard (Cubic meter) of rock excavated, based on survey of in-place surveys volume of before and after removal.
3. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 01 21 00 "Allowances."

C. Unit Price No. 3: Cutting and patching of concrete slabs-on-grade.

1. Description: Cutting of new or existing concrete slabs-on-grade up to [**6 inches (152 mm)**] <**Insert dimension**> thick, removal and excavation as required, and subsequent backfill, compaction, and patching of concrete according to Section 01 73 00 "Execution." not otherwise indicated in the Contract Documents.
2. Unit of Measurement: Square feet (Square meters) of concrete removed.

END OF SECTION 01 22 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under the same conditions as other work of the Contract.

C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Provide new locker installations.

1. Base Bid: Furnish and install new lockers to replace existing lockers as indicated on Drawings A101 through A106 and as specified in Section 10 51 13 "Metal Lockers."
2. Alternate: Furnish and install "Added" lockers in new locations as indicated on Drawing A103, Floor Plan Area C-1 and as specified in Section 10 51 13 "Metal Lockers."

END OF SECTION 01 23 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Request for Substitution Form (RFS): Use facsimile of form following this Section.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section.

Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 10 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

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Request for Substitution (RFS)

USD 320 Wamego School District Improvements

Project Name

RFS No: _____

Date Issued: _____

Project Name: USD 320 Wamego School District Improvement

Issued by: _____

BBN Project No: _____

Copies: _____

Product, Material or Equipment Required of the Contract Documents:

Specification Section: _____ Drawing No./Detail: _____

Description: _____

Requested Substitute Product, Material or Equipment:

Description: _____

Manufacturer: _____ Trade Name: _____

Model Number: _____ Installer: _____

Attachments Included: ☐ Drawings ☐ Product Data ☐ Samples ☐ Test Reports ☐ Comparative Data

Reason for Substitution: _____

Has this item been used in a similar application? ☐ Yes ☐ No

Description: _____

Date Installed: _____

Owner Contact: _____

Comparisons of the Specified Item and the Proposed Substitution:

Compliance with specified quality, size, weight, durability, performance and visual appearance:
Describe any changes required in other elements of the Work:
Describe any changes of the Work required by the Owner, separate Contractors, or Consultants:
Verify all specified warranties, code and accessibility compliance, sustainability, and other requirements are met:
What affect with and without approval of the proposed substitution will there be on the Work Schedule:

Project Name: USD 320 Wamego School District Improvements

RFS No: _____

Provide detailed breakdown of the cost comparison of the required item to the proposed substitution, including modifications required to other Work:
Proposed Substitution Summary: Net Cost to the Owner: Change in Contract Time:

Signatures:

Permission to make any substitution after Award of Contract shall be effected by Change Order (CO). CO shall not relieve the Contractor, any subcontractor, or manufacturer, fabricator, or supplier from the responsibility for any deficiency that may exist in the substituted product or any departures or deviations from the Contract Documents as modified by such CO. Except as otherwise expressly specified by the Contractor in the Request for Substitution (RFS) and expressly approved in such CO, the Contractor shall be deemed to warrant, by his request, that the proposed substitute will satisfy all standards and requirements satisfied by the original product, material or equipment specified and the CO shall not be deemed to modify the Contract Documents with respect thereto. If any substitution will affect a correlated function, adjacent construction, or the work of other trades or contractors, the necessary changes and modifications to the affected work shall be considered as an essential part of the proposed substitution, to be accomplished by the Contractor without additional expense to the Owner if and when accepted. The Contractor shall be deemed to warrant the Net Cost to the Owner and Change in Contract Time stated in this RFS are complete, and claims for additional Cost or Time related to the substitution which may become subsequently apparent are waived.

Contractor's Signature: _____ **Date:** _____

Response:	
RFS Action:	☐ Approved
	☐ Make Corrections Noted
	☐ Revise as Noted and Resubmit
	☐ Rejected, Resubmit Specified Item
	☐ Action Not Taken
	☐ More Information Required

RFS Response by: _____ **Date:** _____

BBN Architects, Inc.

BBN Architects, Inc.		**Contractor:**		**Owner:**	
Accepted By:	_____	**Accepted By:**	_____	**Accepted By:**	_____
Date:	_____	**Date:**	_____	**Date:**	_____

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 01 22 00 "Unit Prices" for administrative requirements governing the use of unit prices.
2. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
3. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedules.
c. Items required to be indicated as separate activities in Contractor's construction schedule.

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

3. Subschedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values coordinated with each phase of payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one-line item for each Specification Section.

1. 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.

2. Arrange schedule of values consistent with format of AIA Document G703.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

      1) Labor.
      2) Materials.
      3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.

   a. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.

5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

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

7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

8. Overhead Costs: Include total cost and proportionate share of general overhead and profit for each line item.
9. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
10. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
11. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and Construction Manager and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment-Application Times: The date for each progress payment is the last day of each month or as otherwise indicated in the Contract Agreement. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 15 days prior to the date for each progress payment.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Construction Manager will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Construction Manager by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Sustainable design submittal for project materials cost data.
4. Contractor's construction schedule (preliminary if not final).
5. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
6. Products list (preliminary if not final).
7. Sustainable design action plans.
8. Schedule of unit prices.
9. Submittal schedule (preliminary if not final).
10. List of Contractor's staff assignments.
11. List of Contractor's principal consultants.

12. Copies of building permits.
13. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
14. Initial progress report.
15. Report of preconstruction conference.
16. Certificates of insurance and insurance policies.
17. Performance and payment bonds.
18. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

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SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project meetings.
5. Digital project management procedures.

B. Related Requirements:

1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Construction Manager, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each principal portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Digital Coordination Drawings: Two-dimensional documents, such as schedules, shop drawings, product data, and general information, shall be submitted electronically in portable document format (PDF) file.

C. Key Personnel Names: Within five days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

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

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Provide coordinated composite drawings, drawn at a scale not less than 1/4 inch per foot in both plan and elevation, including, but not limited to, equipment, ducts, pipe sleeves, piping including plumbing and sprinkler systems, lighting, special supports and other items contained within the space and finished ceiling. Show mechanical and electrical services and architectural and structural features drawn to scale. Provide composite drawings for corridors, specialty spaces, electrical rooms, communication rooms, mechanical rooms, shafts, tunnels, and other areas of limited space with complex systems. Distribute copies of composite drawings to all trades to assure a complete, coordinated installation of work within the space available. Include elevation drawings indicating finish ceiling heights, and heights above finished floor to bottom of ductwork, piping, conduit and other overhead fixtures and equipment.

1) Sheet Size: At least 8-1/2-by-11-inch (215-by-280-mm) paper but no larger than 30 by 40 inches (760 by 1016 mm).
2) Draw required details at a scale not less than 3/4 inch per foot.

c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.

1) Scheduling, sequencing movement, and positioning of large equipment into the building during construction.

g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
h. Refer to Sections of Division 23 and Division 26 for specific Coordination Drawing requirements for mechanical and electrical installations.
i. Indicate relationship of components shown on separate Shop Drawings.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work. Designate fire-rated walls, partitions and floors.
2. Mechanical and Electrical Rooms: Provide coordination drawings for mechanical and electrical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
3. Through Penetrations: Indicate fire-rated and non-fire-rated penetrations and openings required for all disciplines through interior and exterior walls, interior partitions, foundation walls, and floor slabs.
4. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
5. Mechanical and Plumbing Work: Show the following:

   a. Sizes and bottom elevations of ductwork, supply piping, sanitary, floor and roof drain piping, and conduit runs, including insulation, bracing, flanges, and support systems. Indicate access points and required maintenance areas.
   b. Dimensions of major components, such as control boxes, dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.

6. Electrical Work: Show the following:

   a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
   b. Light fixture, exit light, electrified door hardware, access controls, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.

7. Fire-Protection System: Show the following:

   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

8. Site Work: Show the following:

a. Civil and electrical underground utilities, both new and existing.
b. Location of all building/site ground connections/rods.

9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified using the Submittal Exchange.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect and Construction Manager.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect or AIA Document G716.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Architect's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and Construction Manager in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly, with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect and Construction Manager.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.

F. On receipt of Architect's and Construction Manager's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven Insert number days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Web-Based Project Software: Use Construction Manager's web-based Project software site, "Submittal Exchange," for purposes of hosting and managing Project communication and documentation until Final Completion.

1. Web-based Project software site includes, at a minimum, the following features:

   a. Compilation of Project data, including Contractor, subcontractors, Architect, architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
   b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
   c. Document workflow planning, allowing customization of workflow between project entities.
   d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
   e. Track status of each Project communication in real time, and log time and date when responses are provided.
   f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
   g. Processing and tracking of payment applications.
   h. Processing and tracking of contract modifications.
   i. Creating and distributing meeting minutes.
   j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
   k. Management of construction progress photographs.
   l. Mobile device compatibility, including smartphones and tablets.

2. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

B. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

A. General: Construction Manager will schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three days of the meeting.

B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long-lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Procedures for processing field decisions and Change Orders.
    h. Procedures for RFIs.
    i. Procedures for testing and inspecting.
    j. Procedures for processing Applications for Payment.
    k. Distribution of the Contract Documents.
    l. Submittal procedures.
    m. Preparation of record documents.
    n. Use of the premises and existing building.
    o. Work restrictions.
    p. Working hours.
    q. Owner's occupancy requirements.
    r. Responsibility for temporary facilities and controls.
    s. Procedures for moisture and mold control.
    t. Procedures for disruptions and shutdowns.
    u. Demolition and construction waste management.
    v. Parking availability.
    w. Office, work, and storage areas.
    x. Equipment deliveries and priorities.
    y. First aid.
    z. Security.
    aa. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Schedule and conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Construction Manager of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility requirements.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written instructions.
    n. Warranty requirements.
    o. Compatibility of materials.
    p. Acceptability of substrates.
    q. Temporary facilities and controls.
    r. Space and access limitations.
    s. Regulations of authorities having jurisdiction.
    t. Testing and inspecting requirements.
    u. Installation procedures.
    v. Coordination with other work.
    w. Required performance results.
    x. Protection of adjacent work.
    y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Construction Manager will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

    a. Preparation of record documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Submittal of written warranties.
    d. Requirements for preparing operations and maintenance data.
    e. Requirements for delivery of material samples, attic stock, and spare parts.
    f. Requirements for demonstration and training.
    g. Preparation of Contractor's punch list.
    h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    i. Submittal procedures.
    j. Owner's partial occupancy requirements.
    k. Installation of Owner's furniture, fixtures, and equipment.
    l. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Construction Manager will conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.
        4) Deliveries.
        5) Off-site fabrication.
        6) Access.
        7) Site utilization.
        8) Temporary facilities and controls.

9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Construction Manager will conduct Project coordination meetings at regular intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, Construction Manager, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each contractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Sequence of finish installation.
5) Deliveries.
6) Off-site fabrication.
7) Access.

8) Site utilization.
9) Temporary facilities and controls.
10) Work hours.
11) Hazards and risks.
12) Progress cleaning.
13) Quality and work standards.
14) Status of correction of deficient items.
15) Field observations.
16) Requests for interpretations (RFIs).
17) Status of Proposal Requests (PRs).
18) Pending changes.
19) Status of Change Orders.
20) Pending claims and disputes.
21) Documentation of information for payment requests.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Initial construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Special reports.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting schedules and reports and for electronic submittal requirements.
2. Section 01 40 00 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.

B. Initial construction schedule.

1. Approval of cost-loaded, initial construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Initial Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.

4. Earnings Report: Compilation of Contractor's total earnings from Notice to Proceed until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at weekly intervals.

H. Material Location Reports: Submit at weekly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Special Reports: Submit at time of unusual event.

K. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including phasing, area separations, interim milestones, and partial Owner occupancy.
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

    a. Elevators.
    b. Structural steel.
    c. Modular bathrooms

3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
3. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.

d. Partial occupancy before Substantial Completion.
e. Use of premises restrictions.
f. Provisions for future construction.
g. Seasonal variations.
h. Environmental control.

4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Subcontract awards.
b. Submittals.
c. Purchases.
d. Mockups.
e. Fabrication.
f. Sample testing.
g. Deliveries.
h. Installation.
i. Tests and inspections.
j. Adjusting.
k. Curing.
l. Startup and placement into final use and operation.

5. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

a. Structural completion.
b. Temporary enclosure and space conditioning.
c. Permanent space enclosure.
d. Completion of mechanical installation.
e. Completion of electrical installation.
f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:

1. Temporary enclosure and space conditioning.
2. Completion of East Assisted Living Addition (Building A).
3. Completion of Assisted Living Renovation and Addition (Building B).
4. Completion of Community Space Upgrades (Building C).
5. Completion of Independent Living Renovation and Elevator Addition (Building D).
6. Completion of Specialty Care Assisted Living Facility (SCALF) Renovation (Building J).
7. Completion of Short Term Stay Building (Building K)
8. Completion of Long Term Care (LTC) Stand Alone (Building L).

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 01 29 00 "Payment Procedures" for cost reporting and payment procedures.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

2.2 INITIAL CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit initial, horizontal, bar-chart-type construction schedule within 15 days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Initial Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.

    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.

4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the initial network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Work by Owner that may affect or be affected by Contractor's activities.
    i. Testing and commissioning.
    j. Punch list and final completion.
    k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents,and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.

    a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
    b. Total cost assigned to activities shall equal the total Contract Sum.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.

4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.

1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.

B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

C. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 32 00

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 01 31 00 "Project Management and Coordination" for submittal requirements using "Submittal Exchange."
2. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 01 60 00 “Product Requirements” for administrative and procedural requirements for selection of products for use in Project.
4. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
5. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
6. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with initial construction schedule but prior to first application for payment. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Six-Week Look-Ahead Schedules: Maintain and update submittal schedules to reflect current conditions at the project site and project status. Submit revised submittal schedules highlighting the submittals planned in the subsequent six weeks.
4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's and Construction Manager's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Electronic Data: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals upon execution of AIA Document C106, Digital Data Licensing Agreement.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submittal items required for each Specification Section shall be submitted concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

5. Arrange for preparation of required submittals in sufficient detail to permit analysis and review by Architect and Construction Manager**,** sufficiently early to allow for review, and accommodate the rate of construction progress required under the Contract. Delete or mark out extraneous material not relevant to the Project.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on the first full working day following Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 10 consecutive working days for initial review of each submittal. processing must be delayed to permit coordination with subsequent submittals or if concurrent review is required. Construction Manager will advise Contractor when a submittal being processed must be delayed for coordination or concurrent review.
2. Resubmittal Review: Allow 10 consecutive working days for review of each resubmittal.
3. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 15 consecutive working days for initial review of each submittal.
4. Concurrent Consultant Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 15 working days for initial review of each submittal. Submittal will be returned to Construction Manager, through Architect, before being returned to Contractor.

    a. Submit to concurrent reviewer, Architect, and Construction Manager.

5. Extended Review: Allow 20 consecutive working days for initial review of the following submittals:

    a. Coordination drawings.
    b. Windows.
    c. Door hardware.
    d. Electronic security systems.
    e. HVAC temperature controls.
    f. HVAC balancing report.
    g. If more than five shop drawings of a single trade are received in one week.

D. Electronic Submittals: Two-dimensional documents, such as schedules, shop drawings, product data, and general information, shall be submitted electronically in portable document format (PDF) file. Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner**,** containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Construction Manager.
    e. Name of Contractor.
    f. Name of firm or entity that prepared submittal.
    g. Names of subcontractor, manufacturer, and supplier.
    h. Category and type of submittal.
    i. Submittal purpose and description.
    j. Specification Section number and title.
    k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    l. Drawing number and detail references, as appropriate.
    m. Location(s) where product is to be installed, as appropriate.
    n. Related physical samples submitted directly.
    o. Indication of full or partial submittal.
    p. Transmittal number, numbered consecutively.
    q. Submittal and transmittal distribution record.
    r. Other necessary identification.
    s. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

    a. Project name.
    b. Number and title of appropriate Specification Section.
    c. Manufacturer name.
    d. Product name.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect and Construction Manager on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's and Construction Manager's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's and Construction Manager's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website, "Submittal Exchange." Enter required data in web-based software site to fully identify submittal.

    a. Architect, through Construction Manager, will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.

2.2 ACTION SUBMITTALS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable. Delete or mark out extraneous material that is not applicable to the Work. Edit material to conform to project requirements, and to clearly show model number, type and size

proposed. Provide additional information as necessary to supplement standard information.

3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Manufacturer's written recommendations.
    d. Standard color charts.
    e. Statement of compliance with specified referenced standards.
    f. Testing by recognized testing agency.
    g. Application of testing agency labels and seals.
    h. Notation of coordination requirements.
    i. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Mill reports.
    e. Standard product operating and maintenance manuals.
    f. Compliance with recognized trade association standards.
    g. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

    a. PDF electronic file.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    f. Shop fabrication instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Design calculations.
    j. Compliance with specified standards.
    k. Notation of coordination requirements.
    l. Notation of dimensions established by field measurement.
    m. Relationship and attachment to adjoining construction clearly indicated.
    n. Seal and signature of professional engineer if specified.

o. Highlight deviations from the Contract Documents.

2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
4. Do not use Shop Drawings for ordering, fabrication, or construction without an appropriate final stamp from the Construction Manager and Architect indicating action taken in connection with construction.
5. Submit Shop Drawings in the following format:

a. PDF electronic file.

C. Samples: Submit Samples for review of size, kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.

1. Samples are required only for comparable products, substitutions, and custom fabricated items, unless samples are specifically required by the individual Sections.

a. Samples are not required and will not be reviewed if a specified item is being provided.
b. Samples are required and action will be taken if the specified item is no longer available, the manufacturer's current catalog numbers vary from those specified, named manufacturer's product data differs from requirements, or where custom colors require evaluation.

2. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
3. Mount, or display, Samples to facilitate review of qualities specified. Prepare Samples to match the Architect's sample. Include the following identification label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of applicable Specification Section.
e. Specification paragraph number, submittal number, and generic name of each item.
f. Compliance with recognized standards.
g. Availability and delivery time.

4. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
5. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

6. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

   a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, through Construction Manager, will return submittal with options selected.

7. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

2.3 INFORMATIONAL SUBMITTALS

A. Contractor’s Submittal Schedule: Comply with requirements specified in this Section under SUBMITTAL ADMINISTRATIVE REQUIREMENTS.

B. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."

C. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

D. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:

    a. PDF electronic file.

F. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

G. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

I. Project Record Documents: Comply with requirements specified in Section 01 78 39, “Project Record Documents.”

J. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

Q. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

R. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

S. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

T. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

U. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

V. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.4 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic calculation files, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect and Construction Manager will take no action on submittals that have not been stamped and certified.

3.2 ARCHITECT'S AND CONSTRUCTION MANAGER'S ACTION

A. Action Submittals: Architect and Construction Manager will review each submittal, make marks to indicate corrections or revisions required, and return it. The review is for general conformance with the design concept and the information given in the construction documents. Corrections or comments made on the shop drawings/submittal during this review do not relieve Contractor from compliance with the requirements of the plans and specifications. Review of the specific item shall not include review of an assembly of which the item is a component. The contractor is responsible for: dimension to be confirmed and correlated at the job site; information that pertains solely to the fabrication processes or the means, methods, techniques, sequences and procedures of construction; coordination of the work with that of all other trades and performing all work in a safe and satisfactory manner.

B. Construction Manager will stamp each submittal with an action stamp indicating review of submittal before forwarding to Architect.

C. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. **“No Exceptions Taken”** - When the Architect marks a submittal "No Exceptions Taken," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
2. **"Make Corrections Noted”** - When the Architect marks a submittal "Make Corrections Noted," the Work covered by the submittal may proceed provided it complies with

notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.

3. **"Revise and Resubmit"** - When the Architect marks a submittal "Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

    a. Do not use, or allow others to use, submittals marked "Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.

4. **"Rejected" -** When the Architect marks a submittal "Rejected," do not proceed with Work covered by the submittal. The Work covered by the submittal does not conform to the design concept or meet Contract Document requirements.

    a. Do not use, or allow others to use, submittals marked “Rejected – Submit Specified Item” at the Project Site or elsewhere where Work is in progress.

5. **"Submit Specified Item" -** When the Architect marks a submittal "Submit Specified Item," do not proceed with Work covered by the submittal. The Work covered by the submittal does not conform to the design concept or meet Contract Document requirements. Prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.

    a. Do not use, or allow others to use, submittals marked “Rejected – Submit Specified Item” at the Project Site or elsewhere where Work is in progress.

6. **"Action Not Taken"** - Where a submittal is for information or record purposes or special processing or other activity, the Architect will return the submittal marked "Action Not Taken."

D. Informational Submittals: Architect and Construction Manager will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect and Construction Manager will forward each submittal to appropriate party.

E. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect and Construction Manager.

F. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

G. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, Construction Manager, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect or Construction Manager.

C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

D. Benchmarks: Samples that serve as standards by which other work may be measured or judged.

1. Approved benchmark samples shall use full scale, on-site surface areas and spaces. These shall be prepared using the complete specified or approved paint, coating, or decorative system. The sample shall include complete systems.
2. Benchmark samples for interior coating systems shall be prepared only after permanent lighting, heating, venting and air conditioning equipment have been installed and activated.
3. The condition of the surface to be used as the sample area shall be acceptable to the Architect prior to the preparation of the benchmark sample.

E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

K. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as

appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

C. Items indicated on the drawings but not included in the specifications, or included in the specifications and not indicated on the drawings, shall have the same effect as if indicated or included in both. In case of conflict or inconsistency between the drawings and the specifications, the Contractor shall additional information or interpretation as specified in Section 01 31 00 “Project Management and Coordination.” Any adjustment by the Contractor without such determination shall be at its own risk and expense.

1.5 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

B. Qualification Data: For Contractor-engaged testing agencies to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

C. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.6 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Special Inspectors and Contractor's quality-control personnel.

C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

D. Reports: Prepare and submit certified written reports and documents as specified.

E. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 15 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.9 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade jurisdiction settlements and similar conventions.

G. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, through Construction Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect or Construction Manager.
2. Notify Architect or Construction Manager seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's and Construction Manager's approval of mockups before starting work, fabrication, or construction.

a. Allow seven days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed unless otherwise indicated.

K. Benchmarks: Benchmark samples shall be prepared to establish full scale, on-site surfaces to serve as standards by which subsequent work may be measured or judged. Each sample shall be prepared using the complete specified products, materials, or systems.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Testing Agency Responsibilities: Cooperate with Architect, Construction Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Construction Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

D. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

E. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

F. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

G. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, as indicated on Sheet S201 of the Structural Drawings, and as follows:

1. Information for the proposed special inspections firm shall be submitted to the Owner, Architect, and Structural Engineer for approval.
2. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
3. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
4. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect, with copy to Contractor and to authorities having jurisdiction.
5. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
6. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
7. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the General Conditions of the Contract for Construction.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

1. "Installer": Entity engaged by the Contractor, either as an employee or subcontractor, to perform an “Install” construction activity.

    a. Installer shall be experienced in the operations they are engaged to perform.

2. "Experienced Installer": Entity that has successfully completed a minimum of five previous projects similar in size and scope to this Project; is familiar with the special requirements indicated; and has complied with requirements of authorities having jurisdiction.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Materials, equipment, and operations specified by reference to published standards and specifications of a technical society, trade association, or other agency standard, shall comply with the requirements of the current edition of the listed document that is in effect on the issue date of the Specifications or Addendum page making reference thereto, unless otherwise specified. Make available at site, copies of referenced documents as Owner's Representative or Architect may request.

1. No Provision of a reference standard, specification, manual, or code shall be effective to change the duties and responsibilities of the Owner, the Contractor, the Architect and their consultants, their agents and employees from those duties and responsibilities set forth in the Contract Documents.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
2. ICC - International Code Council; www.iccsafe.org.
3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
2. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
3. DOD - Department of Defense; www.quicksearch.dla.mil.
4. DOE - Department of Energy; www.energy.gov.
5. EPA - Environmental Protection Agency; www.epa.gov.
6. FG - Federal Government Publications; www.gpo.gov.
7. HUD - Department of Housing and Urban Development; www.hud.gov.
8. OSHA - Occupational Safety & Health Administration; www.osha.gov.
9. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
10. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
11. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
12. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. FED-STD - Federal Standard; (See FS).
3. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.

4. MILSPEC - Military Specification and Standards; (See DOD).
5. USAB - United States Access Board; www.access-board.gov.
6. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. ADPH: Alabama Department of Public Health

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste-handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails.

B. Fencing Windscreen Privacy Screen: Polyester fabric scrim with grommets for attachment to chain link fence, sized to height of fence, in color selected by Architect from manufacturer's standard colors.

C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures".

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

1. Water Service: Access to Owner's existing water service facilities may be allowed at the discretion of the Owner. Water service facilities shall be cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, these facilities shall be restored to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Toilets: Use of Owner's existing toilet facilities may be permitted at the discretion of the Owner. If permitted, facilities shall be cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, these facilities shall be restored to condition existing before initial use.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.

    a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

H. Electric Power Service: Connect to Owner's existing electric power service provided the service is of sufficient size, capacity, and power characteristic required for construction operations. Maintain equipment in a condition acceptable to Owner.

1. If required, install electric power service overhead unless otherwise indicated.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

J. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

2. Prepare subgrade and install subbase and base for temporary roads and paved areas as indicated on the Drawings.
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

F. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 10 00 "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As indicated on Drawings.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

    a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.

3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
6. Protect air-handling equipment.
7. Provide walk-off mats at each entrance through temporary partition.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.

2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary office spaces, enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. At Substantial Completion, restore Owner-allocated office spaces to condition existing before initial use,
2. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

1. Where applicable, materials and construction shall be in accordance with the City of Edmond Standard Specifications for Construction (Standard Specifications) and Construction Standards.

B. Related Requirements:

1. Section 01 42 00 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor through Construction Manager of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Section 01 33 00 "Submittal Procedures."
    b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products or equipment which will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on accessible, but inconspicuous, surface in occupied spaces. The nameplate shall contain the following information and other essential operating data:

    a. Name of product and manufacturer.
    b. Model and serial number.
    c. Capacity.
    d. Speed.
    e. Ratings.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

B. Provide materials and equipment that are of good quality and new, unless otherwise specified, are free from faults and defects not inherent in the quality required, that conform with requirements of Contract Documents, that are suitable for use and function intended, that are corresponding in quality to related materials in the absence of a complete specification, that are of quality appearance where exposed to view, that are of one manufacturer or source for the same specific purpose, with uniform appearance and physical properties, and that are identical and interchangeable when required in quantity

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

    a. The Architect is solely responsible for evaluation of products and manufacturers submitted as “Or equal” to the specified product or manufacturer.
    b. Submit additional documentation required by Architect through Construction Manager in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Architect, whose determination is final.

C. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements.

        1) Comparable products will be considered unless otherwise indicated.
        2) Substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.

        1) Comparable products will be considered unless otherwise indicated.
        2) Substitutions for Contractor's convenience will not be considered unless otherwise indicated.

    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

D. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

E. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.

B. Related Requirements:

1. Section 01 10 00 "Summary" for limits on use of Project site.
2. Section 01 31 00 "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
3. Section 01 33 00 "Submittal Procedures" for submitting surveys.
4. Section 01 74 49 "Construction Waste Management and Disposal" for administrative and procedural requirements for disposal and salvaging of nonhazardous demolition and construction waste.
5. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

C. Certified Surveys: Submit two copies signed by land surveyor.

D. Final Property Survey: Submit 10 copies showing the Work performed and record survey data.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.

B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Architect and Construction Manager when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, and column grids, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect and Construction Manager.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, reference points, stakes, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Construction Manager before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.

B. Except where more stringent requirements are specified, prepare, install, test, adjust and clean products, materials and equipment in accordance with manufacturer's printed instructions, recommendations and limitations for conditions indicated. Provide recommended accessory materials for a complete installation. If conflict exists between job conditions or specified requirements and with manufacturer's instructions, request written clarification from Architect before proceeding.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Coordination of Space: Where space is limited, install components and systems to maximize space available for maintenance and ease of removal for replacement.

F. Concealed Work: In finished areas, except as otherwise indicated, conceal pipes, ducts, conduit and wiring in the finished construction. Coordinate locations of fixtures, outlets, access panels, and similar items with finish elements. Provide escutcheon plates at penetrations through finished walls, ceilings and floors, with finish appropriate to adjacent finished surface.

G. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

H. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

I. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

J. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

K. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

L. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 49 "Construction Waste Management and Disposal."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious

exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:

1. Excessive static or dynamic loading.
2. Excessive internal or external pressures.
3. Excessively high or low temperatures.
4. Excessive winds.
5. Thermal shock.
6. Excessively high or low humidity.
7. Pollution and air contamination.
8. Water or ice.
9. Chemicals and solvents.
10. Light.
11. Radiation.
12. Puncture.
13. Abrasion.
14. Heavy traffic.
15. Soiling, staining, and corrosion.
16. Bacteria.
17. Rodent and insect infestation.
18. Combustion.
19. Electrical current.
20. High-speed operation.
21. Improper lubrication.
22. Unusual wear or other misuse.
23. Contact between incompatible materials.
24. Destructive testing.
25. Misalignment.
26. Excessive weathering.
27. Unprotected storage.
28. Improper shipping or handling.
29. Theft or vandalism.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

C. Owner reserves the right to protect installed Work to prevent damage and deterioration if the Contractor fails to protect the installed Work in a proper manner. The costs incurred by the Owner shall be paid by the Contractor.

END OF SECTION 01 73 00

SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Salvaging nonhazardous demolition and construction waste.
2. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 04 20 00 "Unit Masonry" for disposal requirements for masonry waste.

1.3 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste for deposit in landfill or designated spoil areas on Owner’s property.

D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for the Notice of Award.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons (tonnes).
4. Quantity of waste salvaged, both estimated and actual in tons (tonnes).

B. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

C. Qualification Data: For waste management coordinator.

D. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

E. Refrigerant Recovery: Comply with requirements in Section 02 41 19 "Selective Demolition" for refrigerant recovery submittals.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

B. Preconstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work in compliance with Section 02 41 19 "Selective Demolition."
2. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate salvage of materials.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Construction Manager's Superintendent will coordinate implementation, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged.
2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Comply with requirements in Section 02 41 19 "Selective Demolition" for salvaging demolition waste.

B. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. General: Except for items or materials to be salvaged, remove waste materials and legally dispose of at designated spoil areas on Owner's property.

C. Burning: Do not burn waste materials.

END OF SECTION 01 74 19

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SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for administrative submittal requirements and electronic submittal requirements.
2. Section 01 73 00 "Execution" for progress cleaning of Project site.
3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 01 79 00 "Demonstration and Training" for requirements for instructing Owner's personnel.
6. Sections of Divisions 21 through 28 for specific closeout requirements relate to mechanical, electrical and plumbing systems.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items (Punch List): Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items (Punch List): Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 working days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Construction Manager's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 working days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.

3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 working days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of Punch List items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

E. Architect's Inspection for Substantial Completion: Except with the consent of the Owner, the Architect will perform no more than 2 inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents.

1. The Owner will be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional inspections.

a. Cost of the Architect's additional services will be calculated in accordance with the hourly rates included in the Agreement between Owner and Architect.
b. Architect will issue a deduct Change Order in the amount of Architect's additional services.
c. Owner will deduct the amount of Architect's additional services from final payment to Contractor.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment.
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (Punch List), endorsed

and dated by Architect. Final version of the Punch List shall state that each item has been completed or otherwise resolved for acceptance.

3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 working days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A or a form acceptable to the Architect.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect and Construction Manager .
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. PDF electronic file. Architect, through Construction Manager, will return annotated file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 working days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Designate specific warranties that will be included in operation and maintenance manuals

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.

h. Sweep concrete floors broom clean in unoccupied spaces.
i. Clean ceramic tile walls and floors.
j. Clean, buff and wax resilient floors.
k. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
l. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
m. Remove labels that are not permanent.
n. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
o. Clean plumbing fixtures, accessories, and trim to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
s. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements established by Construction Manager.

D. Pest Control: Comply with pest control requirements established by Construction Manager. Prepare written report.

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

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SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

    a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit electronic draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 working days before commencing demonstration and training. Architect will return copy with comments.

1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 working days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 01 78 39 "Project Record Documents."

G. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for electronic submittal requirements.
2. Section 01 73 00 "Execution" for final property survey.
3. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
4. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
5. Sections in Divisions 02 through 49 for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Submit PDF electronic files of scanned record documents to the Owner. Include all documents, whether changes were made or not.

a. Final Submittal: Submit PDF electronic files of scanned record prints, including one set of prints with no changes.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 ELECTRONIC DATA

A. Electronic Data: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals upon execution of AIA Document C106, Digital Data Licensing Agreement.

2.2 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Depths of foundations below first floor.
    d. Locations and depths of underground utilities.
    e. Revisions to routing of piping and conduits.
    f. Revisions to electrical circuitry.
    g. Actual equipment locations.
    h. Duct size and routing.
    i. Locations of concealed internal utilities.
    j. Changes made by Change Order or Construction Change Directive.
    k. Changes made following Architect's written orders.
    l. Details not on the original Contract Drawings.

m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect through Construction Manager for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

a. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints and newly prepared record Drawings into manageable data file sets.
2. Format: Annotated PDF electronic file with comment function enabled.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

a. Project name.
b. Date.

c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect and Construction Manager.
e. Name of Contractor.

2.3 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file**.**

2.4 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file**.**

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.5 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file**.**

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's and Construction Manager's reference during normal working hours.

END OF SECTION 01 78 39

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SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Architect.

d. Name of Contractor.
e. Date of video recording.

2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page.
3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
4. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

1.5 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.
    b. Instructions on stopping.
    c. Shutdown instructions for each type of emergency.
    d. Operating instructions for conditions outside of normal operating limits.
    e. Sequences for electric or electronic systems.
    f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in procedures.
    c. Routine and normal operating instructions.
    d. Regulation and control procedures.
    e. Control sequences.

f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 78 23 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.

1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the

following for each Contractor involved on the Project, arranged according to Project table of contents:

a. Name of Contractor/Installer.
b. Business address.
c. Business phone number.
d. Point of contact.
e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

a. Produce segments to present a single significant piece of equipment per segment.
b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

F. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 79 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 03 33 00 "Architectural Concrete" for general building applications of specially finished formed concrete.
2. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-grade.
3. Section 32 13 13 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:

    a. Contractor's superintendent.
    b. Independent testing agency responsible for concrete design mixtures.
    c. Ready-mix concrete manufacturer.
    d. Concrete Subcontractor.
    e. Special concrete finish Subcontractor.

2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, vapor-retarder installation,

anchor rod and anchorage device installation tolerances, steel reinforcement installation, methods for achieving specified floor and slab flatness and levelness, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

E. Samples: For waterstops and vapor retarder.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Welding certificates.

C. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Steel reinforcement and accessories.
4. Fiber reinforcement.
5. Waterstops.
6. Curing compounds.
7. Floor and slab treatments.
8. Bonding agents.
9. Adhesives.
10. Vapor retarders.
11. Semirigid joint filler.
12. Joint-filler strips.
13. Repair materials.

D. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

F. Field quality-control reports.

G. Minutes of preinstallation conference.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

E. Mockups: Cast concrete slab-on-grade and formed-surface panels to demonstrate typical joints, surface finish, texture, tolerances, floor treatments, and standard of workmanship.

1. Build panel approximately 100 sq. ft. (9.3 sq. m) for formed surface in the location indicated or, if not indicated, as directed by Architect.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.9 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301 (ACI 301M).
2. ACI 117 (ACI 117M).

2.2 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

1. Plywood, metal, or other approved panel materials.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

D. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

E. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.

C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.5 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: ASTM C 150/C 150M, Type I/II, gray or white as indicated.
2. Fly Ash: ASTM C 618, Class F or C.

C. Normal-Weight Aggregates: ASTM C 33/C 33M, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm) nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C 260/C 260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

F. Water: ASTM C 94/C 94M and potable.

2.6 WATERSTOPS

A. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle Coatings & Waterproofing Inc.
b. CETCO, a Minerals Technologies company.
c. Henry Company.
d. Sika Greenstreak.

2. Profile: Ribbed with center bulb.
3. Dimensions: 9 inches by 3/8 inch thick (225 mm by 10 mm thick); nontapered.

B. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle Coatings & Waterproofing Inc.
b. CETCO, a Minerals Technologies company.
c. Henry Company.
d. Sika Greenstreak.

2.7 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape; minimum 10 mils thick.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. GCP Applied Technologies Inc. (formerly Grace Construction Products).
    b. Raven Industries, Inc.
    c. Stego Industries, LLC.
    d. W. R. Meadows, Inc.

2.8 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. BASF Corporation; Admixture Systems.
    b. Euclid Chemical Company (The); an RPM company.
    c. L&M Construction Chemicals, Inc.
    d. SpecChem, LLC.
    e. Vexcon Chemicals Inc.
    f. W. R. Meadows, Inc.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Anti-Hydro International, Inc.
    b. BASF Corporation; Admixture Systems.
    c. Euclid Chemical Company (The); an RPM company.
    d. L&M Construction Chemicals, Inc.
    e. SpecChem, LLC.
    f. Vexcon Chemicals Inc.
    g. W. R. Meadows, Inc.

F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation; Admixture Systems.
b. Euclid Chemical Company (The); an RPM company.
c. L&M Construction Chemicals, Inc.
d. SpecChem, LLC.
e. Vexcon Chemicals Inc.
f. W. R. Meadows, Inc.

G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Euclid Chemical Company (The); an RPM company.
b. L&M Construction Chemicals, Inc.
c. SpecChem, LLC.
d. Vexcon Chemicals Inc.
e. W. R. Meadows, Inc.

2.9 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 according to ASTM D 2240.

C. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:

1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.10 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.11 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301 (ACI 301M).

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash: 20 percent or 100 pounds, whichever is less.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing or high-range water-reducing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a w/c ratio below 0.50.

2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Normal-weight concrete.

1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
2. Maximum W/C Ratio: 0.50.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
5. Aggregates shall be proportioned such that mix design shall contain a minimum of 50 percent coarse aggregate per the gradation requirements specified in ASTM C33/C33M.

B. Foundation Walls: Normal-weight concrete.

1. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch (19-mm) nominal maximum aggregate size.
5. Aggregates shall be proportioned such that mix design shall contain a minimum of 50 percent coarse aggregate per the gradation requirements specified in ASTM C33/C33M.

C. Slabs-on-Grade: Normal-weight concrete.

1. Minimum Compressive Strength: 3500 psi (24.1 MPa) at 28 days.
2. Maximum W/C Ratio: 0.45.
3. Minimum Cementitious Materials Content: 540 lb/cu. yd. (320 kg/cu. m).
4. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).
5. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
6. Aggregates shall be proportioned such that mix design shall contain a minimum of 50 percent coarse aggregate per the gradation requirements specified in ASTM C33/C33M.

2.13 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.14 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
2. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M).

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEM INSTALLATION

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORING AND RESHORING INSTALLATION

A. Comply with ACI 318 (ACI 318M) and ACI 301 (ACI 301M) for design, installation, and removal of shoring and reshoring.

B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR-RETARDER INSTALLATION

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.6 STEEL REINFORCEMENT INSTALLATION

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls at maximum 60 feet (18.3 m)on center.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete

when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/4 inch (6.5 mm) or more than 1/2 inch (13 mm) below finished concrete surface where joint sealants, specified in Section 07 92 00 "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOP INSTALLATION

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of

concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

1. Apply to concrete surfaces exposed to public view.

C. Rubbed Finish: Apply the following to smooth-formed-finished as-cast concrete where indicated:

1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix 1 part portland cement and 1 part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. Apply float finish to surfaces to receive trowel finish.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.

1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, paint, or another thin-film-finish coating system.
2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:

a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.

1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.12 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-

place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:

1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches (100 mm) high unless otherwise indicated, and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4000 psi (27.6 MPa) at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
5. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 (ACI 301M) for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

a. Water.
b. Continuous water-fog spray.
c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.

3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

    a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least one month. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.15 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.16 FIELD QUALITY CONTROL

A. Special Inspections: Contractor shall engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports as indicated on Sheet S201 of the Project Structural Drawings.

B. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

END OF SECTION 03 30 00

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SECTION 04 20 00 - UNIT MASONRY

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:

1. Concrete masonry units.
2. Decorative burnished concrete masonry veneer units for Sport Complex Locker Room.
3. Clay brick (Later).
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry-joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.

B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.
3. Cavity wall insulation.

C. Related Requirements:

1. Sheet S201, "General Notes and Schedules" for additional masonry construction and inspection requirements.
2. Section 05 12 00 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
3. Section 07 19 00 "Water Repellents" for water repellents applied to unit masonry assemblies.
4. Section 07 21 00 "Thermal Insulation" for cavity wall insulation.
5. Section 07 62 00 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Colored mortar.
3. Weep holes/cavity vents.

D. Samples for Verification: For each type and color of the following:

1. Decorative CMUs, in the form of small-scale units.
2. Pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.
3. Accessories embedded in masonry.

1.6 INFORMATIONAL SUBMITTALS

A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.

1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

B. Qualification Data: For testing agency.

C. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include material test reports substantiating compliance with requirements.
b. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellent used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for each type of exposed unit masonry construction and typical exterior and interior walls in sizes approximately 72 inches (1800 mm) long by 96 inches (2400 mm) long by high by full thickness, including face and backup wythes and accessories.

   a. Include a sealant-filled joint at least 16 inches (400 mm) long in each mockup.
   b. Include lower corner of window opening at upper corner of exterior wall mockup. Make opening approximately 12 inches (300 mm) wide by 16 inches (400 mm) high.
   c. Include through-wall flashing installed for a 24-inch (600-mm) length in corner of exterior wall mockup approximately 16 inches (400 mm) down from top of mockup, with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
   d. Include water-resistive barrier, sheathing joint-and-penetration treatment, air barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.

2. Where masonry is to match existing, erect mockups adjacent and parallel to existing surface.
3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
4. Protect accepted mockups from the elements with weather-resistant membrane.
5. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

6. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet (6 m) vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) BASF Corporation; Construction Systems.
2) Euclid Chemical Company (The); an RPM company.
3) GCP Applied Technologies Inc. (formerly Grace Construction Products).

C. CMUs: ASTM C 90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of indicated on the Drawings.
2. Density Classification: Lightweight units having an average density less than 105 lb/cu ft (1.680 kg/cu m).
3. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.

4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

D. Decorative CMUs: ASTM C 90.

1. Products Subject to compliance with requirements, provide products by one of the following:

a. **Echelon Masonry -** Trenwyth, “Trendstone Plus Filled and Polished Masonry Units,” with manufacturer’s standard factory-applied water repellent, and extra water repellent for field finish final coat.
b. Anchor Block Company, "**Anchor** Burnished **Masonry Units**~~Block~~" with manufacturer’s standard factory-applied water repellent**, and extra water repellent for field finish final coat**.

2. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi (19.3 MPa).
3. Density Classification: ~~Lightweight~~**Medium-weight**.
4. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
5. Pattern and Texture:

a. Standard pattern, ground-face finish
a. Colors: As selected by Architect from manufacturer's full range.

2.5 MASONRY LINTELS

A. General: Provide one of the following:

B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated. Provide lintels with net-area compressive strength not less than that of CMUs.

C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Davis Colors.
b. Euclid Chemical Company (The); an RPM company.

E. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C 404.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation; Construction Systems.
b. Euclid Chemical Company (The); an RPM company.
c. GCP Applied Technologies Inc. (formerly Grace Construction Products).

H. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation; Construction Systems.
b. Euclid Chemical Company (The); an RPM company.
c. GCP Applied Technologies Inc. (formerly Grace Construction Products).

I. Water: Potable.

2.7 REINFORCEMENT

A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Dur-O-Wal; a Hohmann & Barnard company.
   b. Heckmann Building Products, Inc.
   c. Hohmann & Barnard, Inc.
   d. Wire-Bond.

C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.

1. Interior Walls: Hot-dip galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
4. Wire Size for Cross Rods: 0.187-inch (4.76-mm) diameter.
5. Wire Size for Veneer Ties: 0.187-inch (4.76-mm) diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.

E. Masonry-Joint Reinforcement for Multiwythe Masonry: Brick on both sides of concrete masonry units as indicated on the Drawings.

1. Ladder type with one side rod at each face shell of hollow masonry units more than 4 inches (100 mm) wide, plus one side rod at each wythe of masonry 4 inches (100 mm) wide or less.

2.8 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.

2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.
3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches (100 mm) wide.

1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches (50 mm) long may be used for masonry constructed from solid units.
2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches (32 mm).
3. Wire: Fabricate from 3/16-inch- (4.76-mm-) diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized steel.

E. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- (1.52-mm-) thick steel sheet, galvanized after fabrication.

    a. 0.108-inch- (2.74-mm-) thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.

2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized steel wire.

F. Partition Top Anchors: 0.105-inch- (2.66-mm-) thick metal plate with a 3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

G. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

H. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf (445-N) load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch (1.5 mm).
2. Fabricate wire ties from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized-steel wire unless otherwise indicated.
3. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with projecting tabs having holes for inserting vertical legs of wire tie formed to fit anchor section.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Heckmann Building Products, Inc.
        2) Hohmann & Barnard, Inc.
        3) Wire-Bond.

4. Stainless-Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless-steel shank.

2.9 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:

1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch (0.40 mm) thick.
2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
4. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
5. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637/D 4637M, 0.040 inch (1.02 mm) thick.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Carlisle Coatings & Waterproofing Inc.
        2) Heckmann Building Products, Inc.
        3) Hohmann & Barnard, Inc.
        4) Wire-Bond.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing or flexible flashing with a metal drip edge.
4. Where flashing is fully concealed, use flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings:

1. Solder for Stainless Steel: ASTM B 32, Grade Sn96, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Elastomeric Sealant: ASTM C 920, chemically curing silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

F. Termination Bars for Flexible Flashing: Stainless steel bars 1/8 inch by 1 inch (3 mm by 25 mm).

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

D. Weep/Cavity Vent Products: Use one of the following unless otherwise indicated:

1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Advanced Building Products Inc.
2) Heckmann Building Products, Inc.
3) Hohmann & Barnard, Inc.
4) Wire-Bond.

2. Mesh Weep/Vent: Free-draining mesh; made from polyethylene strands, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe; in color selected from manufacturer's standard.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Advanced Building Products Inc.
        2) CavClear/Archovations, Inc.
        3) Keene Building Products.
        4) Mortar Net Solutions.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advanced Building Products Inc.
    b. CavClear/Archovations, Inc.
    c. Heckmann Building Products, Inc.
    d. Hohmann & Barnard, Inc.
    e. Mortar Net Solutions.
    f. Wire-Bond.

2. Configuration: Provide one of the following:

    a. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail-shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

2.11 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
    b. PROSOCO, Inc.

2.12 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For mortar parge coats, use Type N.

C. Pigmented Mortar: Use colored cement product.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Mix to match Architect's sample.
3. Application: Use pigmented mortar for exposed mortar joints with the following units:

   a. Decorative CMUs.

D. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than strength indicated on the Drawings.
3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.

6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches (100 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

1. For glazed masonry units, use a nonmetallic jointer 3/4 inch (19 mm) or more in width.

C. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

D. Cut joints flush where indicated to receive cavity wall insulation and air barriers unless otherwise indicated.

3.6 COMPOSITE MASONRY

A. Bond wythes of composite masonry together as follows:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. (0.25 sq. m) of wall area spaced not to exceed 24 inches (610 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (914 mm) apart around perimeter of openings. At

intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.

a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.

2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.

B. Collar Joints: Solidly fill collar joints by parging face of first wythe that is laid and shoving units of other wythe into place.

C. Corners: Provide interlocking masonry unit bond in each wythe and course at corners unless otherwise indicated.

1. Provide continuity with masonry-joint reinforcement at corners by using prefabricated L-shaped units as well as masonry bonding.

D. Intersecting and Abutting Walls: Unless vertical expansion or control joints are shown at juncture, bond walls together as follows:

1. Provide continuity with masonry-joint reinforcement by using prefabricated T-shaped units.

3.7 CAVITY WALLS

A. Bond wythes of cavity walls together as follows:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 2.67 sq. ft. (0.25 sq. m) of wall area spaced not to exceed 24 inches (610 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.

a. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.

2. Masonry-Joint Reinforcement: Installed in horizontal mortar joints.

a. Where bed joints of both wythes align, use ladder-type reinforcement extending across both wythes.
b. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) reinforcement with continuous horizontal wire in facing wythe attached to ties.

3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

D. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards, or attach with plastic fasteners designed for this purpose. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.

3.8 ANCHORED MASONRY VENEERS

A. Anchor masonry veneers to wall framing and concrete and masonry backup with masonry-veneer anchors to comply with the following requirements:

1. Fasten screw-attached anchors through sheathing to wall framing and to concrete and masonry backup with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
2. Embed connector sections in masonry joints.
3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and horizontally. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 24 inches (610 mm), around perimeter.

B. Provide not less than 2 inches (50 mm) of airspace between back of masonry veneer and face of insulation.

1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

3.9 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.

3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.10 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1 inch (25 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.11 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

C. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 92 00 "Joint Sealants," but not less than 3/8 inch (10 mm).

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.12 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.13 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), to the termination bar.
3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of inner wythe at least 8 inches (200 mm); with upper edge tucked under water-resistive barrier, lapping at least 4 inches (100 mm). Fasten upper edge of flexible flashing to inner wythe through termination bar.
4. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
5. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches (38 mm) or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.

2. Use wicking material to form weep holes above flashing under brick sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes formed from wicking material 16 inches (400 mm) o.c.

E. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

F. Install cavity vents in head joints in exterior wythes at spacing indicated. Use specified weep/cavity vent products to form cavity vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

3.14 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.15 FIELD QUALITY CONTROL

A. Testing and Inspecting: Engage special inspectors to perform tests and inspections and prepare reports as indicated on Sheet S201 of the Project Structural Drawings. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Testing Prior to Construction: One set of tests.

C. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

D. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

3.17 DECORATIVE CONCRETE MASONRY WATER REPELLENT APPLICATION

A. Apply a final coat of manufacturer's **recommended acrylic** water repellent to decorative concrete masonry unit walls that are completed, cleaned, and fully cured and dry. Apply evenly to cover the entire surface without forming drips or runs and in accordance with the manufacturer's instructions.

3.18 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 20 00 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 20 00

SECTION 05 12 00 - STRUCTURAL STEEL FRAMING

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:

1. Structural steel.
2. Field-installed shear connectors.
3. Grout.

B. Related Requirements:

1. Section 05 31 00 "Steel Decking" for field installation of shear connectors through deck.
2. Section 05 50 00 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame, miscellaneous steel fabrications, and other steel items not defined as structural steel.
3. Section 09 91 00 "Painting" for surface-preparation and priming requirements.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.

C. Delegated-Design Submittal: For structural-steel connections indicated to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator, shop-painting applicators, professional engineer, and testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.

E. Product Test Reports: For the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Shear stud connectors.
4. Shop primers.
5. Nonshrink grout.

F. Survey of existing conditions.

G. Source quality-control reports.

H. Field quality-control and special inspection reports.

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or Endorsement P2 or to SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

E. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated.
2. Use Allowable Stress Design; data are given at service-load level.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.

B. Channels, Angles, M, S-Shapes: ASTM A 36/A 36M.

C. Plate and Bar: ASTM A 36/A 36M.

D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B or Grade C, structural tubing.

E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.

1. Weight Class: Standard.
2. Finish: Black except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

B. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

C. Unheaded Anchor Rods: ASTM F 1554, Grade 36.

1. Configuration: Straight.
2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
5. Finish: Plain.

2.4 PRIMER

A. Primer: Comply with Section 09 91 00 "Painting."

2.5 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

D. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

E. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces of high-strength bolted, slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
5. Galvanized surfaces.
6. Surfaces enclosed in interior construction.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 11, "Power Tool Cleaning to Bare Metal" or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.

D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

3.5 FIELD QUALITY CONTROL

A. Contractor shall engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports as indicated on Sheet S201 of the Structural Drawings.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION 05 12 00

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SECTION 05 50 00 - METAL FABRICATIONS

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:

1. Steel framing and supports for countertops.
2. Steel tube reinforcement for low partitions.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Shelf angles.
5. Metal ladders.
6. Metal bollards.
7. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 03 30 00 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
3. Section 05 12 00 "Structural Steel Framing."

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Prefabricated building columns.
3. Metal nosings and treads.
4. Paint products.
5. Grout.

B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:

1. Steel framing and supports for overhead doors.
2. Steel framing and supports for countertops.
3. Steel tube reinforcement for low partitions.
4. Steel framing and supports for mechanical and electrical equipment.
5. Steel framing and supports for applications where framing and supports are not specified in other Sections.
6. Shelf angles.
7. Metal ladders.
8. Metal bollards.
9. Loose steel lintels.

C. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Mill Certificates: Signed by stainless-steel manufacturers, certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

D. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.

E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: As indicated.
2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 (Z275) coating; minimum 0.079-inch (2-mm) nominal thickness.

F. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

E. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.

1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 09 91 00 "Painting."

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

E. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts for units installed after concrete is placed.

C. Galvanize miscellaneous framing and supports unless otherwise indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

1. Space siderails 18 inches (457 mm) apart unless otherwise indicated.
2. Siderails: Continuous, 1/2-by-2-1/2-inch (12.7-by-64-mm) steel flat bars, with eased edges.
3. Rungs: 1-inch- (25-mm-) diameter steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Harsco Industrial IKG, a division of Harsco Corporation.
        2) SlipNOT Metal Safety Flooring; W.S. Molnar Company.

7. Support each ladder at top and bottom and not more than 60 inches (1500 mm) o.c. with welded or bolted steel brackets.
8. Galvanize and prime ladders, including brackets.
9. Prime ladders with primer specified in Section 09 91 00 "Painting."

2.9 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize and prime miscellaneous steel trim.

D. Prime miscellaneous steel trim with primer specified in Section 09 91 00 "Painting."

2.10 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

1. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
2. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.

B. Prime bollards with primer specified in Section 09 91 00 "Painting."

2.11 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.12 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches (200 mm) unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.13 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.14 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.15 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean iron and steel items of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 09 91 00 "Painting" unless indicated.

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING METAL BOLLARDS

A. Anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch (19-mm) bolts at each bollard unless otherwise indicated.

1. Embed anchor bolts at least 4 inches (100 mm) in concrete.

B. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard. Fill annular space around bollard solidly with nonshrink grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.

C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 00 "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 05 50 00

SECTION 08 11 13 - HOLLOW METAL 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 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.
2. Exterior standard steel doors and frames.

B. Related Requirements:

1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation 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.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
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 each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following members of the Steel Door Institute (SDI):

1. Amweld International, LLC.
2. Ceco Door; ASSA ABLOY.
3. Mesker Door Inc.
4. Pioneer Industries.
5. Republic Doors and Frames.
6. Steelcraft; an Allegion brand.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

B. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. (2.27 W/K x sq. m) when tested according to ASTM C 518.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2; SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches (44.5 mm).
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
   d. Edge Construction: Model 2, Seamless.
   e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
   f. Core: Vertical steel stiffener.
   g. Fire-Rated Core: Manufacturer's standard vertical steel stiffener core for fire-rateddoors.

2. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
   b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3; SDI A250.4, Level A. At locations indicated in the Door and Frame Schedule.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule.
b. Thickness: 1-3/4 inches (44.5 mm).
c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180)coating.
d. Edge Construction: Model 2, Seamless.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
g. Bottom Edges: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
h. Core: Vertical steel stiffener.
i. Fire-Rated Core: Manufacturer's standard vertical steel stiffener with insulation core for fire-rated doors.

2. Frames:

a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A60 (ZF180) coating.
b. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.

2.6 MATERIALS

A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

B. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

C. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

D. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

E. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

2.7 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.

2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.8 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 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. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with SDI A250.11.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames according to NFPA 80.

3. Floor Anchors: Secure with postinstalled expansion anchors.

    a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Solidly pack mineral-fiber insulation inside frames.
5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 CLEANING AND TOUCHUP

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 08 11 13

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SECTION 08 14 16 - FLUSH WOOD DOORS

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:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Requirements:

1. Section 08 80 00 "Glazing" for fire-protection rated glass view panels in flush wood doors.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.

    a. Provide Samples for each species of veneer and solid lumber required.
    b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.

3. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of door, from manufacturer.

B. Sample Warranty: For special warranty.

C. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during remainder of construction period.

1.8 WARRANTY

A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
    b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eggers Industries.
2. Graham Wood Doors; ASSA ABLOY Group company.
3. Marshfield DoorSystems, Inc.
4. VT Industries Inc.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."

1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.

B. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Temperature-Rise Limit: At exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

E. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.

a. Screw Withdrawal, Face: 700 lbf (3100 N).
b. Screw Withdrawal, Edge: 400 lbf (1780 N).

F. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated asfollows:

a. 5-inch (125-mm) top-rail blocking.
b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
d. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.

3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

a. Screw-Holding Capability: 550 lbf (2440 N) per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces.
2. Species: Red oak.
3. Cut: Plain sliced (flat sliced).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Center-balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Exposed Vertical Edges: Same species as faces - edge Type A.
8. Core: Either glued wood stave or structural composite lumber.
9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 LIGHT FRAMES

A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- (1.2-mm-) thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.

1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.6 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. Grade: Premium.
2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
3. Staining: None required.
4. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.

2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 30 "Door Hardware - Science Wing."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

1. Install fire-rated doors according to NFPA 80.
2. Install smoke- and draft-control doors according to NFPA 105.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or 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.

END OF SECTION 08 14 16

SECTION 08 31 13 - ACCESS 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 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

B. Related Requirements:

1. Section 07 72 00 "Roof Accessories" for roof hatches.
2. Section 23 85 00 "Ductwork and Accessories" for heating and air-conditioning duct access doors.

C. Access doors and frames are part of an access door and frame allowance.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.

C. Product Schedule: For access doors and frames.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

A. Flush Access Doors with Concealed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Babcock-Davis.
    b. JL Industries, Inc.; a division of the Activar Construction Products Group.
    c. Karp Associates, Inc.
    d. Nystrom, Inc.

2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: 24 inches by 24 inches (600 mm by 600 mm) or as otherwise indicated on the Drawings are required for specific access.
5. Materials:

    a. General Application: Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage factory primed.
    b. Toilet Rooms and Food Preparation Areas: Stainless-Steel Sheet for Door: Nominal 0.062 inch (1.59 mm), 16 gage, No. 4 finish.

6. Frame Material: Same material and thickness as door.
7. Latch and Lock: Cam latch, screwdriver operated with interior release.

B. Recessed Access Doors with Concealed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Babcock-Davis.
    b. JL Industries, Inc.; a division of the Activar Construction Products Group.
    c. Karp Associates, Inc.
    d. Nystrom, Inc.

2. Description: Door face recessed 5/8 inch (16 mm) for gypsum board infill; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Ceiling.
4. Door Size: 24 inches by 24 inches (600 mm by 600 mm).
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage, factory primed.
6. Latch and Lock: Cam latch, screwdriver operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

A. Fire-Rated, Flush Access Doors with Concealed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Babcock-Davis.
    b. JL Industries, Inc.; a division of the Activar Construction Products Group.

c. Karp Associates, Inc.
d. Nystrom, Inc.

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Locations: Ceiling.
4. Door Size: 24 inches by 24 inches (600 mm by 600 mm).
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch (1.02 mm), 20 gage, factory primed.
7. Frame Material: Same material, thickness, and finish as door.
8. Latch and Lock: Self-closing, self-latching door hardware, operated by key.

2.4 MATERIALS

A. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304. Remove tool and die marks and stretch lines, or blend into finish.

C. Frame Anchors: Same material as door face.

D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.5 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.

E. Latch and Lock Hardware: Furnish number of latches and locks required to hold doors tightly closed. Furnish two keys per lock and key all locks alike.

2.6 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

E. Stainless-Steel Finishes:

1. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
2. Polished Finish: No. 4 finish. Grind and polish surfaces to produce uniform finish, free of cross scratches.

a. Run grain of directional finishes with long dimension of each piece.
b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 51 13 - ALUMINUM WINDOWS

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 projected-out, casement aluminum windows for exterior locations.

B. Related Requirements:

1. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" for coordinating finish among aluminum fenestration units.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review and discuss the finishing of aluminum windows that is required to be coordinated with the finishing of other aluminum work for color and finish matching.
3. Review, discuss, and coordinate the interrelationship of aluminum windows with other exterior wall components. Include provisions for anchoring, flashing, weeping, sealing perimeters, and protecting finishes.
4. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
5. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for aluminum windows.

B. Shop Drawings: For aluminum windows.

1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified, 2 by 4 inches (50 by 100 mm) Insert dimensions in size.

D. Product Schedule: For aluminum windows. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Test Reports: For each type of aluminum window, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For manufacturer's warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating aluminum windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: An installer acceptable to aluminum window manufacturer for installation of units required for this Project.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure to meet performance requirements.
b. Structural failures including excessive deflection, water leakage, condensation, and air infiltration.
c. Faulty operation of movable sash and hardware.
d. Deterioration of materials and finishes beyond normal weathering.
e. Failure of insulating glass.

2. Warranty Period:

    a. Window: 10 years from date of Substantial Completion.
    b. Glazing Units: 10 years from date of Substantial Completion.
    c. Aluminum Finish: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain aluminum windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AAMA certified with label attached to each window.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: AW.
2. Minimum Performance Grade: 80.

C. Air Test Performance Requirements

1. Air infiltration maximum 0.1 cfm per square foot at 6.24 psf pressure differential when tested in accordance with ASTM E283.

D. Water Test Performance Requirements

1. No uncontrolled water leakage at 12.00 psf static pressure differential, with water application rate of 5 gallons/hr/sq ft when tested in accordance with ASTM E331.

E. Condensation Resistance and Thermal Transmittance Performance Requirements

1. Perform thermal tests in accordance with the configuration specified in AAMA 1503.1.

    a. Thermal Transmittance ("U" Factor) shall not exceed 0.46 BTU/hr/sf/deg F at 15 mph exterior wind.
    b. Condensation Resistance Factor (CRF) requirements: CRF minimum 57 (Frame) and CRF minimum 57 (specimen).

F. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C) ambient; 180 deg F (100 deg C) material surfaces.

2.3 ALUMINUM WINDOWS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Manko Window Systems, Inc. Casement Window System Series 3725i or comparable product by one of the following:

1. EFCO Corporation.
2. Kawneer North America, an Arconic company.
3. YKK AP America Inc.

B. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Casement: Project out.
2. Fixed.

C. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

D. Glass: Clear annealed glass, ASTM C 1036, Type 1, Class 1, q3.

1. Kind: Fully tempered where indicated on Drawings.

E. Insulating-Glass Units: ASTM E 2190.

1. Glass: ASTM C 1036, Type 1, Class 1, q3.

a. Tint: Clear.
b. Kind: Fully tempered.

2. Lites: Two.
3. Filling: Fill space between glass lites with air.

F. Integral Louver Blinds: Glass manufacturer's standard, horizontal louver blinds with aluminum slats and polyester fiber cords, located in space between the insulating unit and the take-out interior sash, and operated by hardware located on inside face of sash

1. 5/8 inch wide aluminum slat blinds. Blind color shall be brushed aluminum.

a. Operation: Tilt, raising, and lowering.

2. Tilt-control knob shall be located on the interior face of access panel at the bottom of the right jamb. Raise and lower pull cords shall be located between glass for access only when access panel is opened.

3. Tilt-control knob shall incorporate a “slip clutch” feature.

G. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

1. Dual Glazing System:

a. Interior Lite: Glass.
b. Exterior Lite: Insulating-glass unit.

H. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

I. Projected Window Hardware:

1. Gear-Type Rotary Operators: Complying with AAMA 901 when tested according to ASTM E 405, Method A.

a. Type and Style: As selected by Architect from manufacturer's full range of types and styles.

2. Hinges: Stainless steel concealed four-bar adjustable friction hinges meeting AAMA 904.1, non-friction type, not less than two per sash.
3. Locks shall be single arm roto operators with lift lock. Provide two-point locking for ventilators over 40 inches.

a. Standard project-out cam handle lock

4. Limit Devices: Concealed support arms with adjustable, limited, hold-open limit devices designed to restrict sash opening.

a. Limit clear opening to 6 inches (150 mm) for ventilation; with custodial key release.

J. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

1. Dual durometer PVC, neoprene, EPDM or other suitable material as tested and approved by the window manufacturer.
2. Bulb type at exterior vent members.
3. Securely stake and join at corners. Provide drainage to exterior as necessary.
4. Weather-stripping shall provide an effective pressure-equalization seal at the interior face of the sash ventilator.

K. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Subsills: Thermally broken, extruded-aluminum subsills in configurations indicated on Drawings.

B. Interior Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

C. Panning Trim: Extruded-aluminum profiles in sizes and configurations indicated on Drawings.

D. Receptor System: Two-piece, snap-together, thermally broken, extruded-aluminum receptor system that anchors windows in place.

2.5 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Full, inside for project-out sashes.

B. Aluminum Frames: Manufacturer's standard aluminum alloy complying with SMA 1004 or SMA 1201. Fabricate frames with mitered or coped joints or corner extrusions, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.

1. Tubular Framing Sections and Cross Braces: Roll formed from aluminum sheet.

C. Aluminum Wire Fabric: 18-by-16 (1.1-by-1.3-mm) mesh of 0.011-inch- (0.28-mm-) diameter, coated aluminum wire.

1. Wire-Fabric Finish: Charcoal gray.

2.6 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

1. Bolts, screws or fastenings shall not bridge thermal barrier or impair independent frame movement.
2. Miter corners and mechanically stake over a solid extruded aluminum corner key, leaving only hairline joinery, then seal weather tight.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

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 the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.

B. Install windows 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 to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. 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. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Testing and inspecting agency will interpret tests and state in each report whether tested work complies with or deviates from requirements.

B. Testing Services: Testing and inspecting of installed windows shall take place as follows:

1. Testing Methodology: Testing of windows for air infiltration and water resistance shall be performed according to AAMA 502.
2. Air-Infiltration Testing:

    a. Test Pressure: That required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance class indicated.
    b. Allowable Air-Leakage Rate: 1.5 times the applicable AAMA/WDMA/CSA 101/I.S.2/A440 rate for product type and performance class rounded down to one decimal place.

3. Water-Resistance Testing:

    a. Test Pressure: Two-thirds times test pressure required to determine compliance with AAMA/WDMA/CSA 101/I.S.2/A440 performance grade indicated.
    b. Allowable Water Infiltration: No water penetration.

4. Testing Extent: Three windows of each type as selected by Architect and a qualified independent testing and inspecting agency. Windows shall be tested after perimeter sealants have cured.
5. Test Reports: Prepared according to AAMA 502.

C. Windows will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 08 51 13

SECTION 08 80 00 - GLAZING

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:

1. Glass for windows, doors, interior borrowed lites, and storefront framing.
2. Field-applied privacy film.
3. Glazing sealants and accessories.

B. Related Requirements:

1. Section 10 28 00 "Toilet and Bath Accessories" for framed mirrors.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of the following products; 12 inches (300 mm) square.

1. Coated glass.
2. Insulating glass.
3. Glass film.

C. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturers of insulating-glass units with sputter-coated, low-E coatings.

B. Product Certificates: For glass.

C. Product Test Reports: For coated glass insulating glass, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

1.11 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AGC Glass Company North America, Inc.
2. Cardinal Glass Industries.
3. Guardian Glass; SunGuard.
4. Oldcastle BuildingEnvelope™.

5. Pilkington North America.
6. Vetrotech Saint-Gobain.
7. Viracon, Inc.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.

1. Design Wind Pressures: As indicated on Drawings.
2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
3. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F (W/sq. m x K).
4. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
5. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Flatness Tolerances: Overall bow and warp shall not exceed 50 percent of values tabulated in ASTM C 1048.
2. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated. Direction of roller wave shall be consistent throughout building.

    a. Roller wave peak-to-valley deviation shall not exceed0.003 inch (0.076 mm) "Peak to Valley" in the central area and 0.008 inch (0.2 mm) within 10-1/2 inches (267 mm) of the leading and trailing edge.
    b. Tempered architectural safety glass shall conform to ANSI Z97.1 and CPSC 16 CFR 1201.
    c. Provide heat soak testing conforming to EN14179 which includes a 2-hour dwell at 550°F ± 18°F (290°C ± 10°C).

B. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Sputter-Coated Float Glass: Float glass with metallic-oxide or metallic-nitride coating deposited by vacuum deposition process after manufacture and heat treatment.

2.5 GLASS FILM

A. Decorative Film Overlay: Translucent, dimensionally stable, cast PVC film, 2-mil- (0.05-mm-) minimum thickness, with pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Window Film
b. Avery Dennison Graphics
c. Decorative Films, LLC.
d. digitalFX by Reid Witlin.
e. FDC Graphic Films, Inc.
f. Llumar Decorative Films.
g. Madico Films.

B. Materials: Flexible polyester materials with scratch resistant coatings.

C. Performance Requirements:

1. Scratch Resistance: Decorative films shall average less than 12 percent increase in haze when tested according to ASTM D1044 using a Teledyne Taber Abrader using CS10F Type III wheels each loaded to 0.5 kg for 100 cycles in a 70 percent vacuum.

a. Scratch resistance testing shall be performed by an independent third party agency.

2. Surface Burning Characteristics: Provide films that have Flame Spread Index of 0 and Smoke Developed Index of 30 or less when tested in accordance with ASTM E84.

D. Decorative Film Accessories: General: Provide accessories either manufactured by or acceptable to Decorative film manufacturer for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

1. Pressure sensitive adhesive: This adhesive is activated by pressure and water. It is characterized by its permanently tacky nature and its installation ease..
2. Cleaners, Primers, and Sealers: Types recommended by film manufacturer.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

2. Perimeter Spacer: Thermally broken aluminum with black, color anodic finish.

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) Technoform Glass Insulation NA, Inc.
      2) Thermix; a brand of Ensinger USA.

3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Dow Corning Corporation.
   b. GE Construction Sealants; Momentive Performance Materials Inc.
   c. Pecora Corporation.
   d. Tremco Incorporated.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for

application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 FILM INSTALLATION

A. Preparation:

1. Clean surfaces thoroughly prior to installation.
2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. General: Install in accordance with manufacturer's instructions.

1. Cut film edges neatly and square at a uniform distance of 1/8 inch (3 mm) to 1/16 inch (1.5 mm) of window sealant.
2. Spray the slip solution, composed of one capful of baby shampoo or dishwashing liquid to 1 gallon of water, on window glass and adhesive to facilitate proper positioning of film.
3. Apply film to glass and lightly spray film with slip solution.
4. Squeegee from top to bottom of window. Spray slip solution to film and squeegee a second time.
5. Remove air bubbles, blisters, and other defects.
6. Upon completion of film application, allow 30 days for moisture from film installation to dry thoroughly, and to allow film to dry flat with no moisture dimples when viewed under normal viewing conditions.

C. Decorative Film Overlay: Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges, in single sheet completely overlaying with graphic image as indicated on Drawings to the back face of clean glass, according to manufacturer's written instructions, including surface preparation and application temperature limitations.

3.8 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry

surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.9 MONOLITHIC INTERIOR GLASS SCHEDULE

A. Glass Type 3: Clear heat-strengthened float glass.

1. Minimum Thickness: 6 mm.

B. Glass Type 4: Clear fully tempered float glass.

1. Minimum Thickness: 6 mm.
2. Safety glazing required.

C. Heat Treated Monolithic-Glass: Provide clear heat-strengthened float glass or fully tempered float glass where full tempering is required to resist thermal stresses induced by differential

3.10 MONOLITHIC INTERIOR FILM OVERLAY GLASS SCHEDULE

A. Glass Type GL-5: Glass with decorative film overlay.

1. Glass Type: Clear, heat-strengthened or fully tempered float glass.
2. Glass Thickness: 6.0 mm.
3. Use: Suitable for interior applications.
4. Pattern: As selected by Architect from manufacturer's full range.

3.11 INSULATING GLASS SCHEDULE

A. Glass Type 1 (Item 8.6): Low-E Coated Clear Insulating Glass with Fully Tempered Lites:

1. Basis-of-Design Product: Viracon, Solarscreen 2000 VE 1-2M.
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Indoor Lite: Fully tempered float glass.
5. Interspace Content: Argon.
6. Outdoor Lite: Fully tempered float glass.
7. Low-E Coating: Sputtered on second surface.
8. Winter Nighttime U-Factor: 0.25 maximum.
9. Summer Daytime U-Factor: 0.21 maximum.

10. Visible Light Transmittance: 70 percent minimum.
11. Solar Heat Gain Coefficient: 0.37 maximum.
12. Shading coefficient: 0.43.
13. Relative heat gain: 89 BTU per hour per square foot.
14. Light to solar gain ratio (LSG): 1.9.
15. Safety glazing required for indoor lite.
16. Sealing system: Dual seal, with manufacturer's standard primary and secondary seals
17. Spacer: Thermoset structural silicone foam
18. Desiccant: Molecular sieve or silica gel, or blend of both.
19. IGCC certification: Level CBA.
20. Provide insulating glass units permanently marked either on spacers or on at least one component lite of units with certification label of IGCC.

B. Glass Type 2 (Item 8.xx6): Low-E Coated Clear Insulating Glass with Heat Strengthened Lites:

1. Basis-of-Design Product: Viracon, Solarscreen 2000 VE 1-2M.
2. Overall Unit Thickness: 1 inch (25 mm).
3. Minimum Thickness of Each Glass Lite: 6 mm.
4. Indoor Lite: Heat strengthened float glass.
5. Interspace Content: Argon.
6. Outdoor Lite: Heat strengthened float glass.
7. Low-E Coating: Sputtered on second surface.
8. Winter Nighttime U-Factor: 0.25 maximum.
9. Summer Daytime U-Factor: 0.21 maximum.
10. Visible Light Transmittance: 70 percent minimum.
11. Solar Heat Gain Coefficient: 0.37 maximum.
12. Shading coefficient: 0.43.
13. Relative heat gain: 89 BTU per hour per square foot.
14. Light to solar gain ratio (LSG): 1.9.
15. Safety glazing required for indoor lite.
16. Sealing system: Dual seal, with manufacturer's standard primary and secondary seals
17. Spacer: Thermoset structural silicone foam
18. Desiccant: Molecular sieve or silica gel, or blend of both.
19. IGCC certification: Level CBA.
20. Provide insulating glass units permanently marked either on spacers or on at least one component lite of units with certification label of IGCC.

END OF SECTION 08 80 00

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SECTION 10 21 19 – TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Overhead braced solid plastic toilet compartments configured as toilet enclosures and urinal screens.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For toilet compartments.

1. Include plans, elevations, sections, details, and attachment details.
2. Show locations of cutouts for compartment-mounted toilet accessories.
3. Show locations of centerlines of toilet fixtures.
4. Show locations of floor drains.

C. Samples for each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hinges: Six hinge(s) with associated fasteners.
2. Latch and Keeper: Three latches and keepers with associated fasteners.
3. Door Bumper: Three door bumpers with associated fasteners.
4. Door Pull: Three door pulls with associated fasteners.
5. Fasteners: Thirty fasteners of each size and type.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

2.2 SOLID-PLASTIC TOILET COMPARTMENTS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Scranton Products, "Hiny Hiders" or comparable product by one of the following:

1. Accurate Partitions Corp.; ASI Group.
2. General Partitions Mfg. Corp.
3. Hadrian Manufacturing Inc.

B. Toilet-Enclosure Style: Overhead braced.

C. Urinal-Screen Style: Floor anchored.

D. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.

1. Integral Hinges: Configure doors and pilasters to receive integral hinges.
2. Heat-Sink Strip: Manufacturer's standard continuous, stainless-steel strip fastened to exposed bottom edges of solid-plastic components to hinder malicious combustion.
3. Color and Pattern: Hiny Hiders - Linen (Orange Peel).

E. Pilaster Shoes: Manufacturer's standard design; stainless steel.

F. Urinal-Screen Post: Manufacturer's standard post design of material matching the thickness and construction of pilasters; with shoe matching that on the pilaster.

G. Brackets (Fittings):

1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.

2.3 HARDWARE AND ACCESSORIES

A. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.

1. Material: Stainless steel.
2. Hinges: Manufacturer's minimum 0.062-inch- (1.59-mm-) thick stainless-steel continuous, cam type that swings to a closed or partially open position, allowing emergency access by lifting door. Mount with through-bolts.
3. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
4. Coat Hook: Manufacturer's heavy-duty combination cast-stainless-steel hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories. Mount with through-bolts.
5. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.
6. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.

C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.

2.4 MATERIALS

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M).

B. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

C. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.

B. 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.

C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at bottoms of posts. Provide shoes at posts to conceal anchorage.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.

1. Confirm location and adequacy of blocking and supports required for installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

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.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch (13 mm).
b. Panels and Walls: 1 inch (25 mm).

2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.

a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Urinal Screens: Set pilasters with anchors penetrating not less than 2 inches (51 mm) into structural floor unless otherwise indicated in manufacturer's written instructions.

Attach screens to walls with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact. Level, plumb, and tighten pilasters.

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 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 19

SECTION 10 51 15 - METAL ATHLETIC LOCKERS

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:

1. Welded, open-front athletic lockers: 24-inch-wide by 18-inch-deep by 72-inch-tall (610 mm by 457 mm by 1829 mm) units.
2. Welded, open-front accessible lockers: 24-inch-wide by 22-inch-deep by 72-inch-tall (610 mm by 589 mm by 1829 mm) units.
3. Welded, two-tier athletic lockers: 18-inch-wide by 16-inch-deep by 30-inch-tall (457 mm by 406 mm by 762 mm) units.
4. **Welded, two-tier athletic lockers: 15-inch-wide by 16-inch-deep (381 mm by 406 mm) units with 30-inch-high doors (762 mm).**
5. **Welded, single-tier athletic lockers: 18-inch-wide by 16-inch-deep (457 mm by 406 mm) units with 60-inch-high doors (1524 mm).**
~~4.~~**6.** Locker benches.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

B. Shop Drawings: For metal lockers.

1. Include plans, elevations, sections, and attachment details.
2. Show locker trim and accessories.
3. Include locker identification system and numbering sequence.

C. Samples: For each color specified, in manufacturer's standard size.

D. Samples for Verification: For the following products, in manufacturer's standard size:

1. Lockers and equipment.
2. Locker benches.

E. Product Schedule: For lockers.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Installation instructions.

C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate sizes and locations of bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation of latches and other door hardware.

2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for Welded Metal Lockers: Lifetime from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain metal lockers and accessories from single source from single locker manufacturer.

1. Obtain locks from single lock manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: For lockers indicated to be accessible, comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and.

2.3 WELDED, OPEN-FRONT ATHLETIC LOCKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide DeBourgh Mfg. Co.; All American Collegiate/Pro Model and Open Front Locker - ADA or comparable products by one of the following:

1. ASI Storage Solutions; ASI Group.
2. List Industries Inc.
3. Lyon Workspace Products, LLC.
4. Penco Products, Inc.
5. Republic Storage Systems, LLC.

B. Locker Arrangement: Open front, with seat/footlocker and upper shelf with security box.

C. Material: Metallic-coated steel sheet.

D. Body: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Frames: Continuous 1 inch by 1 inch by 1/8-inch (25 mm by 25 mm by 3 mm) pickled angle iron steel.
2. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
3. Backs: 0.048-inch (1.21-mm) nominal thickness.
4. Shelves: 0.060-inch (1.52-mm) nominal thickness, with double bend at front and single bend at sides and back.

E. Unperforated Sides: Fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet.

F. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet or 0.105-inch (2.66-mm) nominal-thickness steel angles; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames.

G. Reinforced Bottoms: Structural channels, formed from 0.075-inch (1.90-mm) nominal-thickness steel sheet; welded to front and rear of side-panel frames.

H. Seats/Footlockers: Enclosure full width of bottom of metal locker; fabricated from cold-rolled steel sheet.

1. Seat/Lid: 0.075-inch (1.90-mm) nominal-thickness steel sheet; channel formed and reinforced with stiffeners; with manufacturer's standard, steel continuous hinge that is completely concealed and tamper resistant when seat/lid is closed; with padlock hasp.
2. Front Panel: 0.075-inch (1.90-mm) nominal-thickness steel sheet; channel formed at top edge; with minilouvers for ventilation; recessed for padlock loop.
3. Sides: Integral part of unperforated.

I. Security Boxes: Nonperforated, consisting of partition extending from upper shelf to top of metal locker, fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; with channel-formed, 0.060-inch (1.52-mm) nominal-thickness, steel sheet door frame, and door fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet with right-angle single bend at edges; with manufacturer's standard, steel continuous hinge that is completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Single-Point Latching: Stainless-steel strike plate with integral pull; with steel, nonmoving latch hook with steel padlock loop that projects through door and is finished to match metal locker body.
2. Locks: Combination padlocks.

J. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.

K. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

L. Coat Rods: Manufacturer's standard.

M. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

1. Closures: Vertical-end type.

N. Exposed End Panels: Constructed of 1 inch by 1 inch by 1/8-inch (25 mm by 25 mm by 3 mm) steel angle iron frame with 0.060-inch (1.52-mm) sheet steel welded to steel angle frame

O. Materials: Metallic-Coated Steel Sheet; ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.

P. Finish: Baked enamel or powder coat.

1. Color: DeBourgh Code Red.

2.4 WELDED SINGLE AND TWO-TIERED ATHLETIC LOCKERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide DeBourgh Mfg. Co.; All American Team Lockers or comparable product by one of the following:

1. ASI Storage Solutions; ASI Group.
2. List Industries Inc.
3. Lyon Workspace Products, LLC.
4. Penco Products, Inc.
5. Republic Storage Systems, LLC.

B. Expanded-Metal Doors: Fabricated from 3/4-inch (19 mm), 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.125-inch (3.2-mm) nominal-thickness steel angle frame; with 0.090-inch (2.28-mm) nominal-thickness, steel sheet lock panel backed by 0.060-inch (1.52-mm) nominal-thickness, steel sheet retainer welded to door frame.

C. Body and Frames: Assembled by welding body components together. Fabricate from unperforated steel sheet with thicknesses as follows:

1. Sides and Intermediate Partitions: Fabricated from 3/4-inch (19 mm), 0.090-inch (2.28-mm) nominal-thickness expanded metal; welded to 0.125-inch (3.2-mm) nominal-thickness steel angle frame.
2. Tops and Bottoms: 0.060-inch (1.52-mm) nominal thickness, with single bend at edges.
3. Backs: 0.048-inch (1.21-mm) nominal thickness.
4. Cross Frames for Double-Tier Lockers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.

D. Reinforced Bottoms: Structural channels, formed from 0.060-inch (1.52-mm) nominal-thickness steel sheet; welded to front and rear of side-panel frames.

E. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees; self-closing.

1. Knuckle Hinges: Steel, full loop, five knuckles, tight pin; minimum 2 inches (51 mm) high. Provide no fewer than three hinges for each door more than 42 inches (1067 mm) high.

F. Projecting Turn-Handle and Latch: Steel handle welded to manufacturer's standard, three-point, cremone-type latching mechanism consisting of steel rods or bars that engage locker frame at top and bottom of door, and center latch that engages strike jamb; with steel padlock loop.

G. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high.

H. Hooks: Manufacturer's standard ball-pointed, aluminum or steel; zinc plated.

I. Continuous Zee Base: 4 inches (102 mm) high; fabricated from 0.075-inch (1.90-mm) nominal-thickness steel sheet.

J. Continuous Sloping Tops: Fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet, with a pitch of approximately 20 degrees.

1. Closures: Vertical-end type.

K. Materials:

1. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with A60 (ZF180) zinc-iron, alloy (galvannealed) coating designation.
2. Expanded Metal: ASTM F 1267, Type II (flattened), Class I (uncoated), 3/4-inch (19-mm) steel mesh, with at least 70 percent open area.

L. Finish: Baked enamel or powder coat.

1. Color: DeBourgh Code Red.

2.5 LOCKER BENCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ASI Storage Solutions; ASI Group.
2. Lyon Workspace Products, LLC.
3. Penco Products, Inc.

B. Provide bench units with overall assembly height of 17-1/2 inches (445 mm).

C. Bench Tops: Manufacturer's standard one-piece units, with rounded corners and edges.

1. Size: Minimum 12 inches wide by 1-1/4 inches thick (300 mm wide by 32 mm thick) except provide 20- to 24-inch- (508- to 610-mm-) wide tops where accessible benches are indicated.

a. Provide brackets for accessible bench backrest.

2. Laminated clear hardwood with one coat of clear sealer on all surfaces and one coat of clear lacquer on top and sides.

D. Fixed-Bench Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:

1. Tubular Steel: 1-1/2-inch- (38-mm-) diameter steel tubing threaded on both ends, with standard pipe flange at top and bell-shaped cast-iron base; with baked-enamel or powder-coat finish; anchored with exposed fasteners.

a. Color: Match metal lockers.

E. Materials:

1. Steel Tube: ASTM A 500/A 500 M, cold rolled.

2.6 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Equipment: Provide each locker with an identification plate and the following equipment:

1. Coat Rods: For each compartment of each locker.
2. Open-Front Athletic Lockers: Two single-prong wall hooks bolted to locker back and coat rod.

D. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.

E. Accessible Lockers: Fabricate as follows:

1. Locate bottom shelf no lower than 15 inches (381 mm) above the floor.
2. Where hooks, coat rods, or additional shelves are provided, locate no higher than 48 inches (1219 mm) above the floor.

F. Continuous Zee Base: Fabricated in lengths as long as practical to enclose base and base ends; finished to match lockers.

G. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

H. Finished End Panels: Fabricated to conceal unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.

2.7 ACCESSORIES

A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.

B. Anchors: Material, type, and size required for secure anchorage to each substrate.

1. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls, and elsewhere as indicated, for corrosion resistance.
2. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lockers level, plumb, and true; shim as required, using concealed shims.

1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
3. Anchor back-to-back metal lockers to floor.

B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.

C. Equipment:

1. Attach hooks with at least two fasteners.
2. Attach door locks on doors using security-type fasteners.
3. Identification Plates: Identify metal lockers with identification indicated on Drawings.

    a. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach sloping-top units to metal lockers, with closures at exposed ends.

E. Fixed Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 60 inches (1500 mm) apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

1. Provide four pedestals for each accessible bench.

3.3 ADJUSTING

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

3.4 PROTECTION

A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 10 51 15

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SECTION 22 00 00 - PLUMBING

PART 1 - GENERAL **3-4: Specification Section CLARFICATION: 220000-Plumbing-** *ZURN* is an acceptable manufacturer for the mop / service sink.

1.1 WORK INCLUDED:

A. This Section of the Specification includes the furnishing and installation of complete drainage, water supply, plumbing fixtures and other equipment as described herein and as indicated on the Drawings.

1.2 SUBMITTALS:

A. Submit complete printed catalog and descriptive data for each major piece of equipment, clearly indicating exactly what features, options and accessories are being provided.

B. See Section 23 01 00.

1.3 SEWER AND WATER CONNECTIONS:

A. Connections to on site water, sewer and gas services shall be in accordance with the requirements of the 2012 International Plumbing Code and the respective Utility Company. Pay all associated tap and meter fees and costs.

B. Before any new sewer work is done, the Contractor shall uncover the sewer line where connection is to be made and shall determine the actual elevation. If the actual elevation of the sewer at the point of connection is such that the new drainage line cannot be installed with the required slope to the new fixtures, the matter shall be referred to the Architect as soon as possible.

PART 2 - PRODUCTS

2.1 DRAINAGE AND VENT PIPING:

A. Hub-and-Spigot Pipe: Hub-and-spigot cast-iron pipe not larger than 15-inch size shall be service weight ASTM A74, coated. All changes in pipe size of soil, waste, and drain lines shall be made with reduction fittings or reducers. Changes in direction, where space permits, shall be made with long sweep bends, Y-fittings and 1/8 or 1/16-bends, or combination Y and 1/8-bends. Sanitary tee branches and 1/4-bends may be used for connections of branch lines to fixtures and on vertical runs of pipe. Hub-and-spigot cast-iron pipe larger than 15-inch size shall be Type II or III; Grade C, cast-iron pressure pipe.

1. Gasketed Joints: Molded neoprene elastic compression type gaskets. Gaskets shall conform to ASTM C 564, and pipe, fittings, and gaskets shall bear the symbol of the Cast Iron Soil Pipe Institute. Pipe and fittings shall be manufactured with the spigot ends plain

and beveled, and the bells shall be modified to receive the gaskets. Service weight soil pipe and fittings shall be joined with service weight gaskets. Service weight gaskets shall be clearly designated and identified. A lubricant shall be used in making the joints. When the joint is completed, a tight seal shall be formed between the external face of the pipe and the internal face of the bell. Gaskets shall be capable of making and maintaining a tight seal with a deflection not to exceed 5 degrees. Deflection of pipe will not be allowed to avoid the use of a fitting. Joints shall be assembled by the tools and as recommended by the pipe, fittings, and gasket manufacturers.

B. "N0-Hub" Cast-Iron Pipe: "No-Hub" cast-iron soil pipe and fittings shall conform to Cast Iron Soil Pipe Institute Specification 301 and ASTM A-888. Pipe, fittings, and couplings shall bear the symbol of the Cast Iron Soil Pipe Institute. "No-Hub" piping systems shall be installed in accordance with the manufacturer's recommendations.

C. Threaded Steel Pipe: Threaded steel pipe shall be galvanized, Schedule 40 conforming to ASTM A 53.

D. Threaded Copper Nickel Steel Pipe: Threaded copper nickel steel pipe shall conform to ASTM A 714, Grade V, galvanized.

E. Threaded Cast Iron Pipe: Threaded cast iron pipe shall comply with ASTM A-74.

1. Fittings on threaded ferrous soil, waste, and drain piping, including storm drainage piping and couplings on pipes 6- inches and smaller, shall comply with ANSI B 16.12. Short tee branches and short turn elbows may, except for wall hung water closets, be used for connections of branch lines to fixture and on vertical runs of pipe; long turn fittings shall be used in all other locations where space permits. Fittings may be galvanized or black, coated or uncoated. Couplings on pipes 8-inches and larger shall be standard weight steel, zinc-coated (galvanized) and need not be recessed; steel couplings shall not be used on piping 6- inches and smaller.
2. Fittings on threaded ferrous vent pipes shall comply with ANSI B 16.3, B16.4, or B 16.12. Couplings shall be as specified above for soil, waste, and drain piping.

F. Copper Tubing: Copper tubings shall be Type M, in accordance with ASTM B-88, or Type DWV in accordance with ASTM B 306. Ends of tubing shall be cut square and shall be reamed before being made up. Tubing ends shall enter the full depth of the fitting recesses without binding.

1. Fittings for copper tubing shall be solder type, recessed drainage pattern, of wrought copper or cast brass. Recesses shall be smooth and correctly sized to provide proper clearance over the tubing. Solder shall be composition 95/5 tin-antimony or Brigit. Flux shall be noncorrosive. Tubing ends and fitting recesses shall be thoroughly cleaned. Solder shall penetrate fully and shall fill the joint completely.

G. Plastic Pipe and Fittings: Schedule 40 PVC, ASTM D-1784 with solvent welded joints.

2.2 UNDERGROUND WATER PIPING:

A. Underground domestic water piping beyond five feet outside the building shall be as specified by the Civil Engineer.

B. Underground water piping beneath the building to a point five feet outside the building shall be one of the following:

1. Cross-linked polyethylene (PEX).

a. Material Standard: Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third party agency.

1) Standard grade hydrostatic design and pressure ratings from Plastic Pipe Institute.
2) Minimum Bend Radius (cold bending): No less than 6 times the outside diameter. Use a bend support as supplied by the PEX tubing manufacturer for tubing with a bend radius less than stated.
3) Nominal Inside Diameter: Provide tubing with nominal inside diameter, in accordance with ASTM F876.

b. Fittings:

1) Joints below grade shall be avoided if possible.
2) Fittings shall be of a type approved by the piping manufacturer for the application, and shall be supplied by piping manufacturer.
3) Material: Fittings shall be suitable for direct burial in earth, and shall be manufactured from one of the following –
4) Same material as piping.
5) Pollyalloy (ASTM 2359).
6) Bronze (w/ stainless steel sleeve) (ASTM 877).
7) Dezincified brass (ASTM 1807).
8) Material Standard: Comply with ASTM F1960.

c. Accessories

1) Bend supports designed for maintaining tight radius bends shall be supplied by the PEX tubing manufacturer.
2) Tools required to install the piping fittings shall be supplied by the PEX tubing manufacturer.
3) The tubing manufacturer will provide clips and/or PEX rails for supporting tubing runs.

d. Warranty:

1) Warranty Period for PEX piping and fitting system shall be 25-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion.

e. Acceptable Manufacturers – Mr. Pex, Uponor, Viega.

2. Copper tubing, Type K, soft drawn, ASTM B-88.

a. Joints below grade shall be avoided if possible.
b. Where necessary, joints below grade shall utilize fittings of the recessed solder-joint type of either wrought copper or cast brass. Solder shall be silver solder

having a melting point of not less than 1120°F. Adapters for connection to threaded valves, fittings, meters and other equipment shall be cast brass. Recesses shall be smooth and correctly sized to provide proper clearance over the tubing.

2.3 ABOVEGROUND WATER PIPING:

A. Aboveground domestic water piping 3-inches in size and smaller, shall be copper tubing, Type L, hard drawn, ASTM B-88. Fittings shall be one of the following:

1. Recessed solder- joint type of either wrought copper or cast brass. Adapters for connection to threaded valves, fittings, meters and other equipment shall be cast brass. Recesses shall be smooth and correctly sized to provide proper clearance over the tubing. Solder shall be composition 95/5 tin-antimony or Brigit. Flux shall be noncorrosive. The solder shall contain no lead.
2. Mechanical grooved joint pipe couplings may be used for connecting equipment to the piping system, headers, and distribution piping in lieu of soldered tube or fitting connections for water piping with NSF-61 rated temperatures to +180°F. System shall meet the low lead requirements of NSF-372.

    a. Coupling housing clamps shall consist of two ductile iron castings complying with ASTM A-536, cast with offsetting angle-pattern bolt pads. Housing clamps shall hold in place an elastomer water sealing gasket of a FlushSeal® pressure responsive design. Clamps and gaskets shall be manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.)

        1) Victaulic Style 607H ‘Quick-Vic’ installation ready coupling, for direct stab installation without field disassembly.

    b. Fittings shall be manufactured to copper-tube dimensions, ASME B16.22 or ASME B16.18 Victaulic Copper-Connection.
    c. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components. For use with copper-tube dimensioned grooved ends. Victaulic Style 641.
3. Victaulic Installation-Ready™ fittings for grooved end copper tubing shall be manufactured to copper-tube dimensions. Fittings shall be ductile iron conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready™ ends, complete with PVDF (Poly Vinylidene Fluoride) and Grade “EHP” EPDM-HP [Grade ‘T’ Nitrile] gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be rated to 300 psi (2065 kPa) with Type K or L Copper Tubing.
4. Viega ProPress Fitting: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have SC (Smart Connect) feature design (leakage path). Smart Connect ™ (SC Feature) In ProPress ½” to 4" dimensions the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection (when testing from ½ to 85 psi). The function of this feature is to provide the installer

quick and easy identification of connections which have not been pressed prior to putting the system into operation.

B. At contractor's option, branch piping serving toilet rooms and downstream of toilet room isolation valves, and piping serving individual fixtures may be PEX piping as specified for underground water piping.

2.4 UNDERGROUND SOIL, WASTE, VENT AND DRAIN PIPING:

A. Underground soil, waste, vent and storm drainage piping shall be as follows (unless otherwise indicated on Drawings):

1. Underground sanitary and storm drain lines shall be hub- and-spigot cast-iron, or plastic pipe.

2.5 ABOVEGROUND SOIL, WASTE, VENT AND DRAIN PIPING (includes condensate drain piping):

A. Aboveground soil, waste, vent and storm drainage piping:

1. Where exposed in rooms or where located in return air plenums, piping may be hub- and-spigot cast iron, or "No-Hub" cast iron, threaded galvanized steel, threaded copper nickel steel, threaded cast iron, copper tubing, or CPVC pipe. **PVC piping shall not be used where exposed or located in return air plenums.**
2. Where installed inside walls or above ceilings that are not return air plenums, piping may be hub- and-spigot cast iron, or "No-Hub" cast iron, threaded galvanized steel, threaded copper nickel steel, threaded cast iron, copper tubing, PVC or CPVC pipe.
3. Exposed waste piping and fittings in toilet rooms, and in finished areas, shall be chromium plated brass. Pipe shall be red brass, standard weight, iron pipe size and thickness, ASTM B-43, and fittings shall be threaded cast-brass of the recessed drainage pattern. Chromium plated piping shall be carefully measured and cut so that no more than one full turn of thread shall be exposed beyond any fittings. Joints between brass and ferrous pipes shall be threaded.

2.6 TRAPS:

A. Provide deep seal traps on all floor drains.

2.7 CLEANOUTS AND FERRULES:

A. Cleanouts shall be installed as shown on Drawings and where required by the building code.

B. Cleanout plugs for threaded fittings shall be in accordance with Table 52 of CS 188. Except for test openings, where size must be sufficient to admit test plug, bushings will be permitted on pipes 5-inches and larger to reduce plug size to 4-inches; cleanout plugs for piping 4-inches and smaller shall be the same size as the pipe.

C. Cleanout plugs for hub-and-spigot fittings shall be screwed into ferrules caulked into the fitting. Ferrules and plugs shall be in accordance with Table 54 of CS 188.

D. Cleanout plugs on copper drainage lines shall be installed in solder-joint fittings having threaded openings provided for the cleanout, or in solder-joint fittings with threaded adapters.

E. Acceptable Manufacturer - Josam, Smith, Zurn, Wade.

2.8 FLASHING:

A. Openings in roof for waste vent pipes shall be provided with flexible rubber boots clamped to vent pipe and flashed into roofing. Products and installation shall be watertight and shall be approved by the National Roofing Contractor's Association.

2.9 DIELECTRIC ISOLATORS:

A. Provide a dielectric isolator at all points of connection between ferrous and nonferrous piping. Isolators shall be made of Teflon or nylon made up in the form of screwed type unions or insulating gaskets and bolt sleeves and washers for standard flanged connection.

B. Connections may be made with Schedule 80 CPVC nipples, nylon or Teflon bushings selected for the temperatures and pressures of the system.

2.10 VALVES:

A. All valves shall be designed for 125 psi minimum water working pressure, but in no case less than 150% of the system operating pressure, whichever is greater.

B. Provide valves with extended necks in insulated piping.

C. All valves installed in potable systems shall be lead-free in accordance with Federal Government S.3874.

D. Ball Valves:

1. For size 4- inch and smaller shall be 2 piece, full port brass ball valves with RPTFE seats and packing, blow out proof stem, and sweated or threaded ends.

    a. Equivalent to Apollo 77FLF.

E. Check Valves:

1. Check valves 2-inch in size and smaller shall be soldered bronze body, horizontal swing check type with regrindable seat and Buna-N disc.

    a. Equivalent to Nibco S-413.

2. Check valves 2 1/2-inch in size and larger shall be flanged, cast iron, spring actuated, , horizontal swing check type with stainless steel spring, aluminum bronze bushing, Buna-N bonded to bronze seat, and bronze disc.

   a. Equivalent to Nibco F-910-B-LF.

F. Butterfly Valves:
1. 2 through 6-inch, 300 psi (2065 kPa) maximum pressure rating, with copper tubing sized grooved ends. Cast brass body to UNS C87850. Aluminum bronze disc to UNS C95500, with pressure responsive elastomer seat. Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating. Certified to the low lead requirements of NSF-372. Victaulic Series 608N.

G. Acceptable Manufacturers – Apollo, DeZurik, Milwaukee, Nibco, Victaulic, Watts.

H. Automatic Balancing Valves:

1. Automatic flow control valves shall be factory set to a rated flow, and shall automatically control the flow to within ±10% of the rated value over a 40 to 1 differential pressure, operating range, (2 to 80 psid). Valves shall have the capabilities and pressure ratings as indicated and conform to this specification.
2. Automatic balance assembly shall include one or more precision sculptured brass or polyphenylsulfone orifi with an elastomeric diaphragm. Each automatic balancing valve shall automatically control the flow rate to within ±10% of its rated flow, over a temperature range of 32 to 225°F, and a pressure differential range of 2 to 80 psid.
3. Inline copper sweat valves 1/2, 3/4, 1, & 1 1/4 inch shall consist of a wrought copper (ASTM B88-83a) housing. Valve bodies shall be suitable for 522 psig working pressure rating per ASME B31.9 Building Services Piping. Flow rates from 0.5 to 25 gpm shall have a differential pressure operating range of 2 to 80 psid.
4. Equivalent to Hays Model 2511, or Victaulic ICSS TA Series 76X.

2.11 WALL HYDRANTS:

A. Wall hydrants shall be cast bronze, chrome plated nonfreeze type with 3/4-inch inlet and 1-inch copper casing of sufficient length to extend through walls as required to place valve inside the building. Valve rod and seat washer shall be removable through the face of the hydrant. Hydrants shall be furnished complete with adjustment locknuts, union elbows, detachable T-handles, and integral vacuum breaker.

B. Acceptable Manufacturers - Josam, MiFab, Prier, Smith, Wade, Watts, Woodford, Zurn.

2.12 GAS PIPING:

A. Underground distribution piping shall be polyethylene piping conforming to applicable State and Federal Standards. The installation shall be completed by personnel meeting the requirements of applicable State and Federal Standards. Risers to above grade shall be anodeless. Joints shall be fusion butt welded. Provide tracer wire.

B. Aboveground distribution piping 2-inches and smaller shall be Schedule 40 black steel using malleable iron threaded fittings, wrought steel butt welding fittings or pressed fittings.

1. Pressed fittings shall be Viega MegaPress Gas Press Fittings. MegaPress Fittings: ½-inch through 2-inch shall conform to ASME B31.1, ASME B31.3, or ASME B31.9 MegaPress fittings with zinc and nickel coating for use with IPS carbon steel pipe conforming to ASTM A53, ASTM A106, ASTM A135, or ASTM A795. MegaPress fittings shall have an HNBR sealing element, 420 stainless steel grip ring, separator ring, and an un-pressed fitting leak identification feature. Sealing elements shall be verified for the intended use. Installation must be in accordance to manufactuer's instructions and specifications.

C. Aboveground distribution piping 2 1/2-inches and larger, and concealed piping of any size shall be Schedule 40 black steel with wrought steel butt welding fittings, or pressed fittings as specified above.

D. Valves:

1. For sizes 1-inch and smaller, provide ball valves, 125 psig WOG.
2. For sizes larger than 1-inch, provide gas cocks, 125 psi WOG, bronze straight way cocks, flat or square head, threaded ends for 2-inches and smaller, flanged ends for 2 1/2-inches and larger.

2.13 GAS PRESSURE REGULATORS:

A. Regulators shall be single stage, steel jacketed, corrosion resistant, with vent line extended to atmosphere, threaded ends for 2-inches and smaller, flanged ends for 2 1/2-inches and larger.

B. Acceptable Manufacturers - Fischer, Maxitrol.

2.14 FIXTURE SUPPLY PIPING SUPPORTS:

A. Support and position fixture rough-in piping in plumbing chases, shafts, fixture walls or batteries, at each fixture with metal strut framing system or angle iron supports and U- bolt clamps or high impact polystyrene or ABS anchoring channels designed for the purpose. Anchors shall effect positive electrolytic isolation, noise dampening, solid support, and rough-in positioning. See Section 23 20 00 for additional requirements.

B. Acceptable Manufacturers - Sumner, Pipefix, Channel.

2.15 BACK-TO-BACK FIXTURE MANIFOLD:

A. Wherever fixtures utilizing both hot and cold water are installed back-to-back on a partition, the hot water shall be on the left and the cold water shall be on the right on both sides of the partition. Cast bronze manifold fittings designed for the purpose, and to offset around stack may be used.

B. Acceptable Manufacturers - Precision Plumbing Products "BAC 2 BAC", or approved equal.

2.16 SHOCK ABSORBER:

A. Shock absorbers shall be factory fabricated stainless steel casing and bellows with working pressure of 250 psi, bellows precharged with nitrogen. Construction shall be in accordance with Plumbing and Drainage Institute Standard PDI-WH201, ANSI A-11, 2.26.1, and ASSE 1010.

B. Acceptable Manufacturers - Josam, MiFab, Smith, Wade, Watts, Zurn.

2.17 PLUMBING FIXTURES, GENERAL:

A. Provide plumbing fixtures scheduled, at locations and mounting heights indicated on architectural drawings.

B. Provide fixture, trim and equipment specified or of similar quality, design, capacity, appearance and function by acceptable manufacturer listed.

C. Provide required trim for each fixture including faucets, stops, drains, tail pieces, traps and escutcheons.

D. Fixtures fitted to walls shall have backs ground square and true. Caulk juncture of fixture with wall or floor as directed by the Architect.

E. Exposed Pipe - Exposed flush, waste and supply pipes at fixtures shall be chromium plated brass pipe, iron pipe size.

F. Vandalproofing - Provide vandalproof fittings for all fixtures.

G. Acceptable Manufacturers -

1. Fixtures - American Standard, Crane, Gerber, Kohler, Sloan, Toto, Zurn.
2. Stainless Steel Sinks (self-rimming) - Elkay, Just, Kohler, Kindred.
3. Faucets and Drains - American Standard, Bradley, Chicago, Delta, Eljer, Elkay, Gerber, Kohler, Powers, Sloan, Speakman, Symmons, Zurn.
4. Supplies, Stops and Traps - Central, Crane, Dearborn, Eljer, McGuire.
5. Closet Seats - Church, Beneke, Olsonite, Sperzel.
6. Carriers - Josam, MiFab, Smith, Wade, Watts, Zurn.
7. Service Sinks - Florestone, Fiat, Stern-Williams.
8. Floor Drains - Josam, MiFab, Smith, Wade, Watts, Zurn.

2.18 WATER SOFTENER:

A. Water softener shall be complete with two resin tanks and one brine tank and shall remove hardness, (expressed as $CaCo_{2),}$ to the extent that the effluent from the water softener shall contain not more than 5 grains per gallon (0.08 grams per liter) of hardness, determined by an accepted soap hardness test method.

B. The resin tanks shall be designed for a working pressure of 125 psi and hydrostatically tested for 150% of working pressure. Tank shall be constructed from fiberglass reinforced polyester with PVC internal water distribution. Each resin tank shall hold 7 cubic feet of exchange resin.

Each cubic foot of resin shall be capable of removing 30,000 grains of hardness as calcium carbonate when regenerated with 15 pounds of salt.

C. The main control valve shall be top mounted, brass construction with a factory fabricated copper manifold joining the second resin tank. An integral water meter shall record volume and initiate a regeneration based on water usage. The system shall be furnished with a pre-wired 8-foot long grounded electrical cord to plug into a standard 120 VAC power receptacle.

D. The system rated service flow rate shall not be less than 60 GPM with a pressure loss not exceeding 15 psi.

E. A complete water testing kit shall be furnished suitable for wall mounting.

F. Three complete sets of instructions covering the installation, operation and servicing of the water softener shall be provided in booklet form.

G. Install water softening equipment in strict accordance with manufacturer's recommendations.

H. Provide a minimum of 200 pounds of high purity pellet or solar salt for start-up.

I. Provide a minimum of two hours of instruction of the Owner's personnel and initial start-up of water softener system by a factory authorized service representative.

J. Acceptable Manufacturers - Bruner, Culligan, Lakeside Water Treatment, Northstar.

2.19 PIPE HANGERS AND SUPPORTS:

A. See Section 23 01 00.

2.20 WATER HEATER - POWER DIRECT-VENT, GAS FIRED, STORAGE TYPE:

A. Provide AGA approved storage water heater as scheduled, with welded steel tank, polyurethane closed cell insulation, protective sheet metal jacket with baked enamel finish, fully submerged glass-lined condensing heat exchanger, controls, non-sacrificial powered anode rod(s) and temperature and pressure relief valve. Provide water heater with ASME rating when scheduled and for all models with an input rating of 200,000 BTUH or greater.

B. The heater shall be suitable for sealed combustion direct vertical or sidewall venting using PVC air intake and exhaust pipe for a total of 120 equivalent feet of intake pipe, and 120 equivalent feet of vent pipe.

C. The tank shall be fully glass or phenolic epoxy plastic lined after assembly and welding of tank. The tank shall be approved for a working pressure of 160 psi minimum. A hand hole cleanout and a drain valve shall be located near the bottom of the tank. The tank assembly shall be covered by a three year limited warranty against failure due to corrosion, metal fatigue or overheating caused by the buildup of scale, film or sediment.

D. The heat exchanger shall be fully submerged, condensing, spiral shaped, and glass-lined on both water and vent sides to protect against corrosive flue gasses and condensate inside the coil.

E. The heater shall operate at a minimum of 96% thermal efficiency when tested to ANSI Z21.10.3 "Gas Water Heaters". The heaters standby losses shall satisfy ASHRAE 90.1 standards.

F. A microprocessor shall control all heater functions including ignition and temperature regulation. Precise temperature control shall be adjustable from 90 to 180 degrees F. A LCD display shall provide detailed operational and diagnostic information in plain English.

G. The heater shall be completely packaged, requiring only field connection for gas, electrical power, plumbing, and combustion air intake and venting. Provide a thermal expansion tank for the hot water system. Additionally, provide all accessories required to complete water heater installation as scheduled, as indicated on Drawings and as recommended by equipment manufacturer.

H. Provide a thermometer at the outlet of each water heater.

I. Acceptable Manufacturers - A.O. Smith, Lochinvar, PVI, State.

2.21 TEMPERATURE AND PRESSURE RELIEF VALVES:

A. Provide combination temperature and pressure relief valves on each domestic water heater and fired pressure vessel. Valves shall be constructed and rated in accordance with ASME standards, with cast iron bodies, shall be of the diaphragm type, with stainless steel spring, field adjustable, set to relieve above the operating pressure or temperature, but lower than the design pressure of the vessel. Pipe blowoff line full size to 6" above finished floor.

B. Acceptable Manufacturers - Amtrol, Bell & Gossett, Taco, Watts.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION:

A. Do not route piping above electrical distribution equipment, per National Electric Code.

3.2 SOIL, WASTE AND VENT SYSTEMS:

A. Pitch lines at 1/8-inch per foot minimum and 1/4-inch per foot where possible.

B. Below Grade - Install immediately after excavation, lay pipe so that entire length bears on firm soil, excavate for hubs, do not backfill until installation has been observed.

C. Above Grade - Install in structure as high as possible. Independently support each length of cast iron. Support steel pipe according to hanger schedule. Support vertical lines at each floor, both horizontally and laterally.

D. Joints and Fittings for CPVC and PVC plastic piping shall be prepared and solvent welded according to manufacturer's recommendations.

E. Vents - Slope up to high point. Support each length of vent pipe independently within structure.

F. Sanitary Waste Cleanouts - Install cleanouts where required by code and as shown on Drawings. Set floor cleanout covers flush with adjacent finished surface.

G. Floor Drains, Waste Receptors - Install as shown and connect to cast-iron, deep seal "P" trap. Where a water proof membrane is used, anchor membrane to flange with clamping collar and rustproof bolts.

H. Drain Lines - Install drain lines from air conditioning equipment, tanks and other items of equipment requiring regular drainage, to waste receptors. Terminate above receptors with elbow turned down when piping is run horizontal to receptor.

I. Plumbing Fixtures - Rough-in and install plumbing fixtures at height as recommended by the manufacturer unless otherwise indicated on architectural drawings. Caulk perimeter of wall or floor mounted fixture where it meets wall or floor. caulking shall be of type and color as selected by Architect.

3.3 STORM WATER SYSTEMS:

A. Pitch lines at 1/8-inch per foot minimum and 1/4-inch per foot where possible.

B. Below Grade - Install immediately after excavation, lay pipe so that entire length bears on firm soil, excavate for hubs, do not backfill until installation has been observed.

C. Above Grade - Install in structure as high as possible. Independently support each length of cast iron. Support steel pipe according to hanger schedule. Support vertical lines at each floor, both horizontally and laterally.

D. Drains-

1. Set roof drains, and other storm related drains.
2. Connect to piping systems - use rigid connections.
3. Install roof drains with lead flashing and set covers flush with adjacent finished surface.

E. Storm Cleanouts - Install where indicated on Drawings and where required by code.

3.4 DOMESTIC WATER SYSTEMS:

A. Below Grade - Install immediately after excavation, do not backfill until installation has been observed, and lay pipe so that entire length bears of firm soil.

1. Site Verification of Conditions:

a. Verify that site conditions are acceptable for installation of the PEX potable water system.

2. PEX Piping Installation:

a. Do not proceed with installation of the PEX potable water system until unacceptable conditions are corrected.
b. Install PEX tubing in accordance with the tubing manufacturer's recommendations and as indicated in the 2006 Plastic Pipe Institute/Plastic Pipe and Fitting Association/NAHB/PATH Design Guide.
c. Joints below grade shall be limited to those required for tees and connection to valves at connections to buildings.
d. Minimum horizontal supports are to be installed not less than 32 inches between hangers in accordance with model plumbing codes and the installation handbook.
e. Do not expose PEX tubing to direct sunlight for more than 30 days.
f. Ensure no glues, solvents, sealants or chemicals come in contact with the tubing without prior permission from the tubing manufacturer.
g. Protect PEX tubing with sleeves where abrasion may occur.
h. Use tubing manufacturer supplied bend supports where bends are less than six times the outside pipe diameter.
i. Pressurize tubing with air in accordance with applicable codes or in the absence of applicable codes to a pressure of 25 psi (173 kPa) above normal working pressure of the system.
j. Comply with safety precautions when pressure testing, including use of compressed air, where applicable. Do not use water to pressurize the system if ambient air temperature has the possibility of dropping below 32 degrees F (0 degrees C).
k. Field Quality Control:

1) Manufacturer’s Field Services: Provide manufacturer’s field service consisting of product use recommendations and one site visit for inspection of product installation in accordance with manufacturer’s instructions.

B. Above Grade - Run level as high as possible in building structure, install hangers per schedule, allow for expansion and contraction, and anchor where required. Separate hot and cold pipes, with 6-inch minimum clear space between piping. Install 3/4-inch hose end drain valve at low points. Install ball valve at each plumbing fixture or group of fixtures, and at each point of connection to equipment. Allow access to equipment, for removal and servicing of pumps or equipment without draining system.

1. PEX Piping Installation:

a. Install PEX tubing in accordance with the tubing manufacturer's recommendations and as indicated in the 2006 Plastic Pipe Institute/Plastic Pipe and Fitting Association/NAHB/PATH Design Guide.
b. Exposed PEX piping shall be neatly installed plumb and parallel to building surfaces, and supported to eliminate sags and deflections.

2. Copper Piping Installation:

a. For slabs on grade, copper pipe shall be separated from sand fill beneath poured concrete by a minimum of 6 inches of soil backfill.
b. Isolate copper pipe from concrete at all locations where piping penetrates concrete or masonry construction.

C. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

D. Viega ProPress connections: Copper press fitting joints shall be made in accordance with the manufacturer's installation instructions. Pipe shall be approved by manufacturer for use with fittings. Piping shall be square cut, properly deburred, and cleaned. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

E. Connections to equipment:

1. Connect to each plumbing fixture.
2. Connect to each hydrant.
3. Provide valved connections to each piece of kitchen equipment or owner-provided equipment requiring water connection. Provide pressure regulators, pressure reducing valves, vacuum breakers, shock arrestors and other accessories as required for equipment supplied.
4. Provide unions or flanged connections at each piece of equipment connected.
5. Install supply connections to fixtures through wall as high under fixtures as possible.

3.5 WATER HEATER INSPECTION CERTIFICATE:

A. When required by the Kansas Boiler Safety Act for the storage capacity and/or firing rate of the installed water heater, the Contractor shall be responsible for obtaining an inspection and acceptance certificate from the State Boiler Inspector. The Contractor shall schedule and pay for the inspection, and shall post the certificate(s) in the room containing the water heater.

3.6 SHOCK ABSORBERS:

A. Install in accessible locations, see drawings. Provide access panels where required.

3.7 DISINFECTION OF WATER SYSTEMS:

A. General - Disinfect all domestic water systems. Disinfection shall not start until water systems are complete, connections made, and system is flushed out. Upon completion of disinfection, submit certificate and certified bacteriological test report for approval.

B. Follow the method prescribed by the local Health Department, Building Code Department or water purveyor. In the absence of a prescribed method, follow the procedure outlined in either AWWA C651 or AWWA C652.

3.8 GAS PIPING SYSTEM:

A. Above Grade - Run level and as high as possible. Install hangers per schedule. Allow for expansion and contraction. Anchor where required. Install Schedule 10 carbon steel welded gas tight pipe casing around piping in concealed vented areas. Pipe casings to be vented to atmosphere. Pipe casings not required in exposed areas.

B. Below Grade - Installation shall meet the requirements of applicable State and Federal Standards.

C. Above Roof - Support piping at no more than 8 feet on center, with manufactured pipe supports: Miro Industries Model 3-R or approved equivalent. The pipe supports shall be a roller- bearing type designed to support piping or conduit, and to absorb thermal expansion and contraction of piping or conduit thus preventing damage to roof membrane. The pipe or conduit shall rest on a polycarbonate resin roller and a glass-filled nylon rod situated in a polycarbonate resin seat.

D. Connections to equipment - Connect at each appliance or gas using device and provide gas cock unions, and dirt leg.

3.9 TESTING:

A. Systems shall be tested in accordance with the 2012 International Plumbing Code prior to insulating, covering or concealing this work.

B. Plug or cap lines for testing and disconnect equipment and devices which may be damaged by excessive test pressures.

C. Before final connections are made to site sewer and connection of fixtures, all underground drainage piping shall be hydrostatically tested. All openings shall be capped or plugged and the system filled with water to the top of a vertical section of pipe 10 feet high, temporarily connected to the highest point of the underground system. The water shall be allowed to stand in the system for at least 30 minutes prior to inspection. If the water level remains constant and no leaks are found during the period of inspection, the water shall be drained form the system. Final connections shall then be made to the site sewer and the trenches backfilled.

D. Before any fixtures are connected, all sanitary drain and vent systems, and storm drainage systems above ground, shall be hydrostatically tested. All opening shall be capped or plugged and the systems filled with water. The water shall be allowed to stand in the systems for at least 30 minutes prior to inspection. If the water level remains constant and no leaks are found during the period of inspection, the water shall be drawn off and fixtures, etc., connected. No parts of a system shall be tested with less than 10-foot head of water. No parts of a system using cast iron bell-and-spigot pipe shall be tested with more that a 40-foot head or water, and no parts of a system using screwed piping shall be tested with more than 200-foot head of water. The Contractor shall be responsible for determining the amount of piping he wishes to test at one time, but the above conditions shall not be exceeded.

E. Before final connections are made to a water supply system, all underground water piping shall be hydrostatically tested and proven tight at a pressure of not less than 100 psi or 50 psi in excess of the working pressure, whichever is greater, at the lowest point in the system. The pressure shall be maintained for at least 1 hour for inspection, the water shall be drained from

the system. Final connections shall then be made to the water supply system, and the trenches backfilled.

F. Before any fixtures or equipment are connected, all domestic water and compressed air systems connected thereto above ground shall be hydrostatically tested and proven tight at a pressure of not less than 100 psi or 50 psi in excess of the working pressure, whichever is greater, at the lowest point in the system. The pressure shall be maintained for at least 2 hours for inspection. If the pressure remains constant and no leaks are found during the period of inspection, the water shall be drained from the systems and final connections shall then be made to the fixtures, etc.

G. All tests shall be made when there is no danger of freezing, prior to enclosure of any parts of the systems by furrings, suspended ceilings, etc.

H. Test to demonstrate the capacities and general operating characteristics of all equipment, such as water heating outfits, pumps, water coolers, etc., shall be made under the direction of the Architect at the time of final inspection and under conditions imposed by him. Water heaters having steam or water coils shall be tested with the main heating system in operation.

I. Gas piping shall be tested in accordance with the requirements of the local building code and the 2012 International Fuel Gas Code.

J. All tests shall be made in the presence of and results approved by the Architect.

K. Should any leaks, flaws, or defective materials or equipment be found during the testing operations, such leaks or flaws shall be corrected, and defective materials and equipment replaced. All defective joints shall be remade, and calking or threaded joints will not be acceptable. After corrections have been made, tests shall be repeated until all systems are proven tight and satisfactory. All corrections and retests shall be made at Contractor's expense.

3.10 CLEANING:

A. See Section 23 01 00.

3.11 COMPLETION:

A. Complete each piping system in its entirety. Properly support the system, clean the interior surfaces of the pipe by flushing, and disinfecting domestic water piping as specified. Leave systems filled and free from air, and ready for operation and testing.

END OF SECTION 22 00 00

SECTION 114000 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to work of this section. As defined, the coordinating trade shall be solely responsible for assigning and dividing the work among the trades as necessary to accomplish the requirements of the Contract Documents.

B. Related Division; Refer to the following Divisions and their Sub-Sections for materials, installation and code requirements related to surrounding surfaces, rough-in and connections to Food Service Equipment specified here-in. Refer to 1.6 - Coordination, "Architectural, Mechanical and Electrical Requirements" within this section for related work to be completed by the trades responsible for the following Divisions.

1. Divisions 02 through 14 (excluding Section 114000) and Architectural drawings for materials, construction, installation and code requirements related to adjacent / surrounding / abutting construction at food service equipment.
2. Division 03 Section "Cast-in-Place Concrete" for the following:
    a. Requirements for slab depressions.
    b. Insulated concrete slabs within walk-in refrigerator / freezer boxes.
3. Division 06 Section "Rough Carpentry" for redwood thermal breaks.
4. Division 07 Section "Thermal Protection" for insulation beneath walk-in refrigerator / freezer concrete slab floors.
5. Division 09 Section "~~Non Structural Metal Stud Framing~~**Gypsum Board Assemblies**" for steel stud spacers in recessed pits at perimeter of insulated concrete floored walk-in refrigerator / freezer.
6. Division 12 Sections for Manufactured Wood Veneer Faced & Plastic Laminate Clad Casework.
7. Division 21 - Fire Suppression for ventilation hood fire-extinguishing systems.
8. Division 22 - Plumbing sections for service roughing-ins; drain traps; atmospheric vents; valves, pipes, and fittings; sub slab ventilation; and other materials required to complete foodservice equipment installation.
9. Division 23 - Heating, Ventilation and Air Conditioning (HVAC) sections for supply and exhaust fans; exhaust duct work; air curtains, roof curbs and commercial kitchen ventilation hoods.
10. Division 26 - Electrical sections for connections to fire alarm systems; wiring; disconnect switches; sub slab heat tapes; and other electrical materials required to complete foodservice equipment installation.
11. Division 27 - Communications
12. Divisions 28 - Electronic Safety And Security.

1.2 SUMMARY

A. This Section includes equipment for the food service facilities indicated on the drawings. Extent of food service equipment work is indicated on drawings and by provisions of this section, including schedules and equipment lists associated with either drawings or this section.

B. Upon request, the successful bidding provider of food service equipment will be required to provide an itemized breakdown of cost for each individual equipment item. Owner will use the list, when necessary, for value engineering only.

C. Installation shall include uncrating, setting-in-place, cleaning and leveling of new equipment, so it is ready for fittings / controls installation & utility connections by other trades. Installation shall also include removal, relocating, cleaning (of construction generated soils & debris), re-installing and leveling of current equipment designated to be relocated, as here in after specified, so it is ready for fittings / controls installation & utility connections by other trades. Currently installed equipment is presently in operation within the current central kitchen located at the Wamego High School, 801 Lincoln St. Wamego, KS. The owner will relocate all small wares, utensils, etc. Coordinate removal of all existing equipment with Owner, Architect and other trades. Equipment designated for relocation is the responsibility of the provider of food service equipment during construction and any damage to such will be their responsibility. Plumbing, mechanical and electrical connections to new and relocated equipment shall be done by other trades.

D. Removal of currently installed equipment must be coordinated closely with the owner.

E. The provider of food service equipment, having; reviewed plans and specifications, shall be fully satisfied as to his obligations here-in stated, as shown and as required for a completed, properly operating installation at project completion before submitting his bid. No allowance will be made to the provider of food service equipment for any error on his part, or obvious oversight not called to the attention of the Food Service Consultant at least Ten (10) days prior to bidding.

F. Provide as part of the Contract, a qualified food service equipment project foreman at job site, during all phases of construction relating to this contract. Foreman shall have the technical expertise to handle all phases of equipment installation. Foreman shall coordinate recessed floor slab layout, roughing-in equipment, equipment installation and connections, with all other trades at job. Foreman shall answer questions and determine locations for making required cut outs, etc., for satisfactory final installation. Discrepancies between food service requirements and plumbing, mechanical and electrical work shall be immediately forwarded to Architect/Food Facilities Consultant in writing.

G. The specifications and drawings are complementary and what is called for by the one shall be binding as if called for by all. Verification of quantities is the responsibility of the provider of food service equipment.

H. Connection Plan drawings reflect point of connection locations on equipment and not rough-in locations.

I. Definitions;

1. Reference to Food Facility Consultant, whenever used in these specifications, shall mean Montgomery Hoffman Associates, Inc., 2400 SW. 29th ST., Suite 122, Topeka, Kansas, 66611, Phone (785) 266-5696, FAX (785) 266-4655, E-Mail randy@mhaconsulting.com.
2. These specifications are in abbreviated form and contain incomplete sentences. Omissions of word or phrases such as "The provider of food service equipment shall", "Shall", "shall be" "as noted on drawings", "according to the drawings", "a", "an", "the" and "all" are intentional. Omitted words and phrases shall be supplied by inference.
3. "By Owner" refers to Owner-Furnished Equipment; equipment / items to be relocated / provided by the owner or his supplier and is outside the contractual obligations of this project.
4. "Contract Documents" consists of the agreement between the owner and contractor(s) (prime and secondary) and all requirements therein related to Section 114000 Food Service Equipment including but not limited to; conditions of the contract (Division 1, general and supplementary); all specifications; all drawings; all addenda issued prior to receiving of bids; all modifications, all change orders and all construction change directives.
5. "Coordinating Trade" or "Trade responsible for coordinating all construction" refers to the person/entity/contractor solely responsible for supervising and directing the work as identified in the owner/contractor agreement.
6. "EC" refers to the electrical trade.
7. "Electrical Trade" refers to the person/entity/contractor solely responsible for providing the electrical work associated with installation and equipment connection.
8. "Equipment" means food service equipment unless otherwise designated.
9. "FSC", "Food service equipment provider", "provider of food service equipment" and "trade responsible for food service equipment" refer to the trade or entity solely responsible for providing, supplying and installing food service equipment specified here-in Section 114000 and as shown on the food service drawings.
10. "Foreman" within this section, means the provider of food service equipment and his Foreman, unless otherwise indicated.
11. "GC" refers to the coordinating trade.
12. "Install", means assemble / set in place and/or mount equipment ready for installation (by other trades) of fittings and accessories supplied by the food service equipment provider and connections/inter-connections (by other trades).
13. "MC" refers to the mechanical trade.
14. "Mechanical Trade" refers to the person/entity/contractor solely responsible for providing the mechanical work associated with installation and equipment connection.
15. "Other trades" refers to trades other than those responsible for providing food service equipment as specified in 114000.
16. "PC" refers to the plumbing trade.
17. "Plumbing Trade" refers to the person/entity/contractor solely responsible for providing the plumbing work associated with installation and equipment connection.
18. "Provide", means to acquire and install.
19. "Provider" refers to the trade responsible for acquiring and installing items designated as "Required".
20. "Relocated" refers to equipment to be moved, by the food service equipment provider, from their currently installed locations in other locations, as described.

21. "Required" or "Req'd" designates an obligation by the food service equipment provider to supply / provide the designated equipment item / service as specified.
22. "Standard", "Standard Construction", "Specification of Standard" refer to construction techniques, materials, methods and configurations specified in "Specification of Standard for Custom Fabricated or Modified Equipment" within this section.
23. "Supply", means to acquire and relinquish to other trades for installation.
24. "Trade" refers to the person/entity/contractor solely responsible for providing the construction activity associated with the use of the term.
25. "Vendor" refers to an owner contracted supplier, outside the contractual obligations of this project, who will provide the designated equipment at the direction of the owner.

1.3 SUBMITTALS

A. Rough-in Plans: Dimensioned rough-in plans, and diagrams, prepared for this project must be submitted within thirty (30) days after receipt of Contract. Submit dimensioned Electrical, Plumbing and Mechanical rough-in plans **FOR ALL UTILITIES SHOWN ON THE CONNECTION PLAN**, inclusive of rough-ins associated with utilities not directly associated with equipment provided by the food service equipment provider (ie: convenience outlets, relocated, etc.). The utility rough-in plan shall be a "rough-in" plan and not a "point-of-connection" plan. It shall include the following for all shown / specified Required, Relocated, By Owner and By Vendor equipment.

1. Equipment identification on all equipment & rough-in plans, equipment & rough-in lists - schedules and notes shall reference the same Item No. designated on the contract document FS plans and as designated here-in.
2. A Food Service Equipment Plan which clearly shows equipment locations with dimensionally correct equipment outlines and clearances. Architecturally related notes and dimensions, as required for general building construction and equipment installation shall be included. Plan equipment shall be designated with their item number. An equipment schedule with item number, quantity, description and remarks / notes shall be provided.
3. Two (2) separate plans, one each for plumbing/mechanical and electrical, which clearly show lateral and longitudinal dimensions of electrical receptacles / switches / junction boxes, water lines, waste lines, floor sink/drains/troughs, and hood location and as required for rough-in of utilities by other trades. Floor sinks/drains located to be accessible, allowing easy removal of the grate, and located not to be in conflict with table legs, cabinet toe bases or other non-mobile equipment.
4. Lateral, longitudinal and height dimensions, locating rough-in points for utility connections from fixed points (i.e. wall, columns, etc.). Where walls are directly adjacent to equipment, all Mechanical and Electrical rough-ins shall occur within those walls to minimize floor obstructions. Floor penetrating rough-in locations at island equipment locations (ie: tables, sinks, etc.) shall be under equipment adequately so it's not exposed readily to abuse or presents a hazard to the equipment user. Conduit stub ups at abacking tables shall occur between the tables, centered on the back splashes and a minimum of 6" in from the table ends.
5. Utility connection sizes, loads, characteristics, etc., for equipment at its rough-in points. Include additional notes, as necessary, to explain connection requirements to the trade(s) responsible for making final connections.

6. Utility sizing and locations shall be in accordance with exact equipment to be provided / supplied and its installation.
7. Diagrams showing proper assemblage, installation, and inter-connection/connection of parts provided / supplied by the food service equipment provider, and installed by other trades.
8. Wall, roof, floor and ceiling openings required for complete installation of equipment.
9. Notes explaining special or unusual conditions which affect work of other trades.

    a. Note location of in wall blocking for wall supported equipment.

10. Schedules of symbols and abbreviations.

B. Fabrication Drawings: Before start of equipment fabrications, submit Fabrication Drawings on custom built equipment including plans, elevations, and sections. Fabrication drawings shall be at scale not less than 1" = 1'-0" and in full detail, complete with detail notes, materials listings with gauges, fixtures and fittings, finishes. Drawings shall accurately represent the equipment as it is to be fabricated including; dimensions for all sizes and locations; show all punched holes; all coves; edge, backsplash and rim configurations; all underbracing, mounting brackets, support brackets; legs, casters and crossrails; work / scrapping / wash sink bowls; undershelves and elevated shelves; drawers and enclosures; dish table configurations; exhaust ducts; chases, enclosure panels and fillers; cabinet bases; receptacle boxes; etc. as specified herein and as shown.

C. Product Data: Provide Buy-out Equipment Specification books containing manufacturers technical product data and installation instructions on all non-custom, standard, manufactured equipment. Food facility consultant shall correct or make a list of corrections to the submittals. Buy-out Equipment Specification books shall include the following for each equipment item, arranged by item number in the book;

    1. A cover sheet listing Item No., description, manufacturer, model number, electrical voltage / phase / amperage / wattage, NEMA plug configuration, **all quantities / options / accessories as required by the contract documents - as necessary for proper operation - as necessary for accurately procuring the equipment.**
    2. Manufacturers standard catalog specification sheets with specifications, features, utility connection locations and requirements as necessary for the installing trade(s) to make final connections.

D. Unintentional approval of submitted incorrect/incomplete Shop Drawings and Specification sheet books shall not waive obligation of the food service equipment provider to provide / supply equipment, materials and construction methods as shown and specified herein.

E. Maintenance Data: At minimum, furnish to the Owner Three (3) sets of bound maintenance and parts manuals, for all items of standard manufacture. Assemble manuals in book form, arranged by item number. Provide an index in the front listing Item No., Description as shown on Food Service drawings and manufacturer. Manuals shall also include copies of warranties extending past the manufacturers standard, operating and maintenance instructions, adjustment and testing instructions; parts listing, and other applicable information necessary for proper maintenance and care of equipment. When available, provide equipment manufacturers operation and maintenance

video tapes in the VHS, CD or DVD format. At least (1) one copy of the completed manual shall be available at the owner demonstration for reference by the demonstrator and owner.

F. Authorized Service Agencies: At minimum, furnish to the Owner Three (3) lists of local and/or nearby service agencies which have been authorized by previous agreement with the provider of food service equipment, to make emergency service calls, for each piece of custom built or buy-out food service equipment, having mechanical or electrical components provided / supplied under this Contract. **Provide a minimum of Two (2) service agencies, for each piece of equipment, from which the owner may select.** List shall include specific equipment name, model no. and serial no. both authorized service agent's name, address and phone number.

G. Warranties; At minimum, provide to the owner Three (3) equipment warranty books. Provide at the front of each book, a warranty listing in columnar form of all equipment used on the project. In landscape format, using Microsoft Word, develop the warranty listing as follows;

1. Provide a header at the top of each page of the warranty listing, designating the Project Name, food service equipment provider Company Name, Project Manager, Address and Phone Number. Below this project information, in bold letters, designate the "Warranty Initiation Date_____" (Refer to 1.10 Service and Warranties).
2. Below the header, designate across the top of each page, columns for Item No., Description, Manufacturer, Model No., Serial No., Warranty Period and Comments. Comments column used to designate specifics (where they apply) such as " year labor, 3 years materials'" For items having multiple components with varying warranties, list each component and its information, on a separate line below the specific item number. Fill in all columns for each item.
3. Additionally, provide in each warranty book, a CD-R containing the warranty listing saved in a ASCII DOS Text format. CD-R clearly labeled with project name and "KITCHEN EQUIPMENT WARRANTIES". CD-R in a protective sleeve secured to the inside of the front leaf of the warranty book.
4. Behind the warranty listing, provide in order by item number, manufacturers standard warranty certificates. Designate the item number on each certificate and fill in all appropriate information as required by the equipment manufacturer. Food service equipment provider is responsible for submitting to the manufacturer all appropriate information for initiating warranties.

1.4 QUALITY ASSURANCE

A. Mechanical, plumbing, and electrical custom fabricated and buy-out equipment, work, materials and installation shall meet applicable regulations and codes, including but not limited to:

1. AGA (American Gas Association); Provide gas burning equipment which complies with and is listed by the AGA.
2. ANSI (American National Standards Institute) Standards: electric powered and gas-burning appliances, plumbing fittings including anti-siphonage water fittings and compressed gas piping shall meet applicable standards of the American National Standards Institute.
3. ASHRAE15, "Safety Code for Mechanical Refrigeration."
4. ASME (American Society of Mechanical Engineers); Provide steam-generating and direct-

steam heating equipment that is fabricated and labeled to comply with ASME Boiler and Pressure Vessel Code.

5. BISSC (Baking Industry Sanitation Standards Committee) Standards: Provide bakery equipment that complies with BISSC's "Sanitation Standards for the Design and Construction of Bakery Equipment and Machinery."
6. Clean Air Act for Stationary Refrigeration & Air Conditioning. (Protection of the Ozone, Recycling and Emission Reduction Program).
7. Energy Independence and Security Act of 2007; Walk-in refrigerators / freezers and their refrigeration systems shall comply.
8. Health Codes; National, State and Local which have jurisdiction including but not limited to;

    a. Kansas Department of Agriculture, Kansas Food Code 2012. City and state food service health and sanitation requirements.
    b. City and local jurisdictional health and sanitation requirements.

9. Montreal Protocol for installation and use of non-CFC content refrigerants and reduced HCFC content refrigerants.
10. NEMA (National Electric Manufacturers Association); Electrically operated buy-out and custom fabricated equipment shall conform to latest standard of National Electric Manufacturers Association
11. NFPA (National Fire Protection Association) Codes: equipment shall be manufactured and installed in accordance with applicable standards of the National Fire Protection Association (NFPA) codes including.
12. NSF (National Sanitation Foundation) Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF/ANSI standards.
13. UL (Underwriters Laboratories) Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards and that are UL certified for compliance and labeled for intended use.

B. The provider of food service equipment Qualifications: The company or its sub-trades shall;

1. Be regularly engaged in the supplying and installation of food service equipment of types, capacities, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
2. Have technical personnel experienced in all aspects of procuring and installing the food service equipment specified here-in.
3. Have the financial ability to handle this project and be able to provide documentation supporting their capacity to the Owner's satisfaction.
4. Be regularly engaged in the manufacture of custom built food service equipment with the necessary facilities, manufacturing equipment and personnel to draw and manufacture food service equipment of the highest quality in accordance with the best accepted practices of the industry.
5. Have successfully completed installations of similar size and complexity.
6. Have expertise in field welding, finishing, and adjustment of equipment to fit field conditions with a neat and uniform installation per the best accepted practices of the industry.

C. When requested by Montgomery Hoffman Associates, bidding provider of food service equipment and their sub-trades shall provide qualification information including a list of previous similar projects, their location, monetary size of contract and a reference architect/food facility consultant/owner contact.

1.5 PROJECT CONDITIONS

A. Delivery, Storage, Handling: New equipment shall be delivered in factory-fabricated containers designed to protect equipment and finish until final approval. Coordinate size of access and route to place of installation. Make arrangements to receive equipment at the project site. The provider of food service equipment is responsible for, determining when construction activities are sufficiently complete to begin installations without risking damage to the equipment, for protection of the equipment until final approval.

B. Site Visits: Food service equipment provider shall visit site to; direct, check and verify location of all rough-ins before floor slabs are poured; coordinate floor drain / sink locations and elevations; to check framing; take all field measurements; make templates of field wall/floor conditions for accurate fabrication of equipment; to supply and provide equipment to fit job conditions; to direct coordinating trade.

C. Equipment shall be consistent with these specifications and accompanying drawings.

D. All questions concerning this contract shall be directed to the Architect/Food Facilities Consultant.

E. Install work as shown on drawings. Examine job conditions and advise Architect/Food Facility Consultant in writing, before starting work, if any changes are required because of discrepancies between Specifications and Drawings and actual conditions.

F. All equipment shall fit space provided and job conditions. Conditions causing major or unusual alteration to specified equipment, shall be brought to the Architects/Food Facilities Consultants attention in writing, before equipment is constructed or installed. Minor adjustments of equipment to fit field conditions, including added length, are the responsibility of the provider of food service equipment and not grounds for an additional charge.

G. It is the purpose of these Drawings and Specifications to procure Food Service Equipment, both special fabricated items and items of general manufacture that conform to the best operating policies of the industry. These items have been selected as preferred items as a result of past experiences in functional design, construction, material and in maintenance and repair.

H. The bidding food service equipment provider is responsible for providing a bid amount for each piece of equipment shown or specified. If equipment specified has been discontinued, bidder shall submit a comparable piece for approval at least 10 day prior to the bid date. Manufacturer discontinuance does not relieve the bidder from providing a comparable piece of equipment.

I. Buy-out or equipment of standard manufacture shall be of latest model or succeeding model at time of delivery and include all standard accessories as designated in the latest catalog.

J. Non serial numbered equipment and equipment which doesn't require field measurement for accurate fabrication may be purchased following approval of shop drawings and stored in their factory provided packaging/crating in a bonded warehouse (per the requirements of Division 1) until the installation date. Installed equipment shall be like new without damage or physical deterioration . Warranties on all operational equipment items shall comply with 1.7 Warranty, paragraph D. - Initiation of Warranty ...

L. All equipment except those designated as "Relocated", their accessories and parts shall be new, without previous use and meet all conditions required for this project.

M. Equipment price increases not included in bidders proposal, will not be allowed after the bid opening.

1.6 COORDINATION

A. Coordinate work with work of other trades at project site and carefully schedule work with job progress.

1. Verify coordinating trade has planned installation of roof curbs required for walk-in refrigeration systems.
2. Verify coordinating trade is aware of recessed slab requirements for walk-in refrigerator / freezer units.
3. Verify coordinating trade is aware of slab requirements and ceiling height clearances at roll-in convection ovens.

B. Architectural, Mechanical & Electrical Requirements;

1. It is the intent of this specification that the provider of food service equipment will provide and supply all food service equipment and their accessories with the trades responsible for mechanical, plumbing and electrical work installing accessories and providing all material and labor for all rough-in, inter-connections and final connections necessary for proper operation of the equipment. The provider of food service equipment shall oversee proper connection to the equipment.
2. The trade(s) responsible for work in Architectural Divisions 02 through 14 (excluding Section 114000) will furnish materials, labor and construction for adjacent / surrounding / abutting surfaces to food service equipment specified here-in, including but not limited to:

    a. Walls, ceilings, floors and their related finishes.
    b. Concrete wear surface in walk-ins.
    c. Roof penetrations.
    d. Sealing of unfinished concrete floors and masonry walls.

3. The Trade responsible for plumbing work will; furnish labor and material to rough-in, inter-connect and make connection / interconnection to equipment as here-in specified, and shown/noted on the contract document drawings including but not limited to; items designated as "G", "H", "C", "D", "IW"; provide complete, ready for use installation of items designated "BY PC" and "BY PLUMBING TRADE"; test food service equipment internal

piping systems for possible leaks incurred during shipping; install hard piping and reducing fittings necessary to extend piping to the designated equipment connection point. The Trade responsible for plumbing work will install & connect / interconnect equipment accessories supplied by the provider of food service equipment including but not limited to;

a. Faucet & pre-rinse fittings.
b. Drains & tailpieces.
c. Food Waste Collection systems and components.
d. Water filtration / softening systems.
e. Wall sleeves for routing of refrigeration lines through walls, as located by trade responsible for food service equipment.
f. Extend walk-in evaporators condensate lines to drain.
g. Reel hose assembly, control valves and vacuum breakers.
h. Gas pressure regulators.
i. Flow control valves and water inlets.
j. Gas & water quick disconnect hoses, stop valves, fittings and restraining cables.
k. Dish machine waste water tempering kit nipples, strainer, solenoid valve, back flow preventer, ball valve and PVC waste water piping.
l. Miscellaneous fittings required for proper operation of equipment shown & specified, unless noted otherwise. The plumbing trades' responsibility includes but is not limited to providing; floor sinks & drains; piping for water, waste and gas; shut-off & stop valves; grease traps and interceptors, "P" traps, unions, back flow prevention devices (except as provided within this section, ref. specific equipment items) etc., as required for proper operation of the equipment. Plumbing work shall comply with Division 21 & 22 of the specification.

4. The Trade responsible for mechanical work will furnish labor and material to rough-in, inter-connect and make connection to equipment as here-in specified, and shown/noted on the contract document drawings. Mechanical work shall comply with Division 23 of the specification. Responsibility includes but is not limited to; items designated "BY MC" and "BY MECHANICAL TRADE"; provide air changes / ventilation of all kitchen related spaces; provide exhaust and supply ductwork, flues, exhaust fans, supply fans, air balancing, related parts and accessories as required for proper operation of the equipment. The Trade responsible for mechanical work will provide, install & interconnect / connect equipment accessories including but not limited to;

   a. Provide cooking equipment ventilation hoods.
   b. Provide hood fire suppression systems.
   c. Provide condensate ventilation hoods.
   d. Provide connection to, exhaust ductwork and exhaust fan(s) for roll-in convection oven ventilation hoods provided by the provider of food service equipment.
   e. Provide ductwork and connections to dishwasher and specialty equipment requiring ventilation as described
   f. Roof curbs for walk-in refrigerator / freezer condensers.

5. The Trade responsible for electrical work will rough-in, inter-connect and make connection / interconnection to equipment as herein specified and shown/noted on the contract document

drawings including but not limited to; connections to control/J-boxes designated as "EC" on the connection plan; provide final and ready for use installation of items designated "ER", "BY EC" and "BY ELECTRICAL TRADE"; inspect and tighten loose electrical connections caused by shipping. The Trade responsible for electrical work will install & connect / interconnect equipment accessories supplied by the provider of food service equipment including but not limited to;

a. All remote compressor / condensers and related time clocks and accessories.
b. All walk-in box related solenoids, contractors, controls, lights, door heaters, threshold heaters, vent heaters, thermostats, etc.
c. Table mounted electrical receptacles.
d. Food waste collector controls / components.
e. Ice cubers and dispensers.
f. Waste water tempering control panel, thermostats, solenoid;
g. Miscellaneous components required for proper operation of equipment shown & specified, unless noted otherwise. The electrical trades responsibility will include but is not limited to conduit, wiring, fittings, switches, line and disconnect switches, etc., as required for proper operation of the equipment. Electrical work shall comply with Division 26 of the specification.

6. The provider of food service equipment shall supply for installation by other trades, accessories as noted in work of other trades above and as specified here-in. The provider of food service equipment will provide / install the following food service equipment ready for installation of accessories and utility connections / interconnections by the plumbing, mechanical and electrical trades;

a. Walk-in boxes - condensers - evaporators - refrigerant piping
b. Cooking equipment with water and gas hoses,
c. Work tables & sinks with electrical receptacle boxes where noted,
d. Dish tables, dish machines, booster heaters and waste water tempering systems
e. Food waste collection systems.
f. Faucet, pre-rinse, hose and drain fittings.
g. Food preparation equipment,
h. Refrigerator / hot holding cabinets,
i. Ice machines,

D. The manufacturer of food service equipment shall pre-wire or wire all new food service equipment and accessories to the designated "EC" control or junction box on the equipment for installation of accessories & connection / interconnection by the trade responsible for electrical work, unless noted otherwise. The manufacturer of food service equipment shall extend plumbing and mechanical systems to a designated utility connection point on all new equipment for installation of accessories & final connection by the trade(s) responsible for plumbing & mechanical work, unless noted otherwise.

E. Supply each motor driven appliance or electrical heating unit, with suitable starter of correct type or control switch, in accordance with the UL listing. Provide motors with overload protection. All other line switches, fittings, and connections shall be furnished and installed by the trade

responsible for electrical work, except as otherwise specified.

F. Electrical devices, controls, switches, etc., built into or forming an integral part of custom fabricated equipment are furnished and installed by the trade responsible for electrical work in electrical outlet/switch boxes provided in/on the equipment by the provider of food service equipment. All wiring / conduit above 34" routed in chases / shelf supports and concealed from view.

G. Cord lengths shall be suitable for installation conditions. Neatly fasten excess cord length in place with approved nylon cable straps, clamps, or equally suitable device to insure against accident to cords. Coil and strap excess cord length on all equipment.

H. The provider of food service equipment shall verify and coordinate all plug types to assure proper mating with receptacles provided by the trade responsible for electrical work.

I. Exposed Stainless Steel ductwork provided by the provider of food service equipment, shall be extended from equipment outlets to 3" above finished ceiling where the trade responsible for mechanical work will make connection. Ventilators and/or hoods specified hereinafter shall be provided with duct connection opening, or collars to which the trade responsible for mechanical work will make connection.

1.7 WARRANTY

A. The food service equipment provider shall fully guarantee / warranty all work and materials for a minimum period of one (1) year from date of acceptance.

B. Provide five (5) year warranty for motor-compressor at each remote or self-contained condensing unit supplied with buy-out or custom fabricated refrigeration equipment provided under this Contract.

C. Extended warranty and conditions of service on items of standard manufacture, as established by manufacturer of such equipment, shall apply where extending beyond warranty and conditions of service set forth in these Specifications. Provide written manufacturer's warranty to the Owner, when any guarantee or warranty extends beyond above mentioned one (1) year warranty period.

D. Initiation of warranty period shall occur on the First Day of Effective Use of equipment by the owner. First Day of Effective Use will be the first day, following substantial completion acceptance, that the kitchen is used to produce a full meal. Equipment start-up and testing, by the food service equipment provider, his sub-contractors, service agents or other parties / trades responsible for setup or connections, will not start the warranty period. Substantial Completion Acceptance of food service equipment shall not be interpreted to be the initiation of the warranty period unless it falls within 30 days prior to the First Day of Effective Use. Food service equipment provider shall notify Food Service Consultant / Architect, in writing at least 10 days prior to bid date, of Manufacturers who are not accepting of this policy. Rejection of this policy is grounds for disallowance of manufacturers equipment. Manufacturers equipment which is bid is understood to be in acceptance of this policy.

E. Immediately upon written notice from Owner, and as directed, the provider of food service equipment agrees to repair or replace without cost to Owner, defects in workmanship of materials, not due to abuse, appearing within above mentioned time. Trips to job for servicing of equipment under guarantee shall be made without charge, but such trips shall be made only at direction of Owner or Owner's previously identified agent.

1.8 REFRIGERATION REQUIREMENTS

A. Walk-in refrigerators / freezers and their refrigeration systems shall comply with the Energy Independence and Security Act of 2007.

B. The provider of food service equipment shall supply and install, ready for all connections, all remote compressors and accessories for Food Service Equipment, as specified herein. The Trades responsible for electrical and plumbing work will rough-in, inter-connect and connect-up equipment & accessories.

C. The food service equipment provider shall do all "Refrigeration Installation".

D. "Refrigeration Installation" shall include; uncrating and setting-in-place of compressors and accessories, installation of refrigerant lines and refrigeration accessories, initial charge of refrigerant for each system, system(s) start-up, testing and temperature adjustment.

E. Installation Equipment:

1. Refrigerant line sizes shall be of proper size to operate units, at temperatures required. Refrigeration system manufacturer shall size refrigerant lines to operate units at the temperatures required. Refrigerant piping to remote compressors shall be field installed (non-pre-charged) Type "L" copper, labeled ACR, with wrought copper fittings and sweat solder joints. Make connections with silver solder having melting point of not less than 1000deg. F. Run and test refrigeration systems and piping prior to application of insulation. After successfully testing, evacuate system and charge per manufacturers recommendations.
2. Insulate suction lines per applicable code requirements for composite smoke and fire hazard. Insulation shall be 3/4" "Armaflex AP", black, flexible, elastomeric tubing with flame spread rating of 25 or less and smoke developed rating of 50 or less. Cover fittings with "Armaflex AP" blanket and wrap with vapor proof tape. "Armaflex" blanket shall be neatly applied with no buckles or gaps using the manufacturers recommended adhesive and installation procedures. Seal seams weather tight with longitudinal seams at bottom of pipe.
3. Protect "Armaflex AP" installed outside the building envelope with PVC sleeving sealed with vapor barrier adhesive and strapped at 18" O.C. and at each 90deg. fitting with non-removable plastic strapping.
4. Support exterior vertical and horizontal refrigerant lines at 6'-0" O.C. maximum with adjustable hangers and supports secured to the building structure to prevent movement. Exterior piping routed tight to exterior vertical surfaces; maximum of 6" above horizontal surfaces. Support interior refrigerant lines at maximum 6'-0" O.C. horizontally and 10'-0" O.C. vertically with adjustable hangers and supports secured to the building structure to prevent movement. Insulate hangers and supports from direct contact with cold surfaces using 1" plastic foam inserts, premolded pipe insulation or wood blocking of same insulating

value as adjacent insulation. Protect insulation with insulation shields supporting the lower 180deg. of pipe insulation.

F. Provide initial charge of refrigerant, (type as hereinafter specified) for each refrigeration system. Provide initial charge of lubricating oil, for compressor unit, in accordance with manufacturer's recommendation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The food service equipment bid shall quote only manufacturers listed with-in the specification or addenda. Hereinafter, where specific mention is made of catalog number of any particular manufacturer or trade name, it shall be understood that such mention is made for purpose of establishing type, design and/or quality of material and equipment desired. Food Facilities Consultant will review equipment submitted by other than specified manufacturers for acceptance as equivalent to the specified if submitted within no later than 10 days to the bid date. All equipment submitted must meet or exceed the quality, design and function of the specified equipment. The food service equipment bidder requesting review of the alternative manufacturer shall submit complete construction details, brochures and comparison sheets to the equipment specified. If the submitted equipment varies in size from the specified or will require any changes in the shown mechanical, electrical, ventilation or structural building systems, the bidder shall call these to the Architects/Food Facility Consultants attention in considering the submitted equipment. The bidder making such submission shall cover all costs for any modifications to equipment, mechanical, plumbing, electrical, ventilation or structural systems which may be necessary. Such equipment will be approved, approved with requisites, or rejected and noted as such in the last addenda issued. Only equipment which is specified or approved as equivalent by addenda may be bid.

2.2 FABRICATED EQUIPMENT

A. Materials:

1. Stainless Steel: AISI Type 304; austenitic; meeting NSF/ANSI 51 Food Equipment Materials with minimum 18% chromium; 8% - 10.5% nickel; 1% - 2% Manganese. Provide non-magnetic sheets, free of buckles, waves, and surface imperfections. Provide No. 4 polished finish for any surfaces exposed to view, 2B or 2D finish on unexposed surfaces. Only in areas exposed to high temperature and high acid/chloride exposure, type 316 Stainless Steel will be used.
2. Stainless Steel Tube: ASTM A 554, Type 304 with no. 4 polished finish.
3. Sound Deadening:

    a. For all sound deadening applications; Component Hardware Q75-2000 Multiflec Sound

Deadener or equal, heavy-bodied resinous coating, filled with granulated cork or other resilient material, compounded for permanent, non-aging, non-flaking adhesion to metal. Spray apply in 1/8" thick coating and paint aluminum.

b. For Metal/Dish Table Tops only; Component Hardware Tack Tape, or equal, sound deadening, tape form of sound deadening applied between table reinforcing and metal top.

4. Sealant for Food Preparation Equipment: Sealant shall be ASTM C 920, Type S Grade NS, Class 25, use NT sealant which is an easily cleanable **CLEAR** silicone sanitary sealant which does not support bacterial growth, Shore A hardness of 30. Single component, chemical curing, non-sagging, non-staining, fungus resistant, non-bleeding. Sealants shall;

   a. Product; Pecora Corporation 898 Silicone Sanitary Sealant, or approved equivalent.
   b. Color; Translucent.
   c. Movement Capability; Plus and minus 50 percent.
   d. Service temperature range; -40 to +300 degrees F.
   e. Shore A Harness Range; 30
   f. Certified for compliance with NSF standards for use in food service areas.
   g. Washed and cured sealant shall comply with the FDA's regulations for use in areas that come in contact with food.

5. Sealant for Low Temperature Conditions; Adhesive sealant for low temperature use shall be Kason Industries model 3700 Rubbaseal Silicone Sealant. Premium grade, fully NSF certified silicone adhesive sealant; waterproof; air-cures overnight; tack-free in 15 min.; standard temperature formula serviceable from -80degree F to 450degree F. (-62degree to 232degree C).
6. Elastomeric Joint Sealant: ASTM C 920; Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.
7. Cylindrical Sealant Backing: ASTM C 1330, Type C, closed-cell polyethylene, in diameter larger than joint width.

B. Specification of Standard for Custom Fabricated or Modified Equipment:

1. Following are specifications, for all custom fabricated equipment to be specified hereinafter, and shall be followed where referred to by work "Standard", "Specification of Standard", "Standard Specification", or where otherwise applicable. Custom fabricated / modified equipment shall be built / modified per these standards unless altered by the a specific Item specification. Item specific specifications take precedence over these standards.
2. All custom fabricated equipment, materials and workmanship, shall be best of their respective kinds and equal in detail, quality and construction.
3. Neatly cut and finish all openings in equipment required by other trades for electrical and plumbing leads.
4. Welding:

   a. All piecing or jointing, exposed to view on top surfaces, back splashes, cabinet faces, shall be done with continuous welded joints. Weld joints shall be flush and smooth free

of all depressions, cavities, ridges and impurities.
b. Tack welding is only acceptable when out of view from 3'-0" eye level.
c. Pop rivet fasteners and exposed to view screws and bolts are not allowed.
d. No soldered joints, cold solder or caulked fillets allowed.

5. Grinding and Polishing:

a. Grind smooth all welds. Polish out all welds, weld discolorations, and brake marks occurring in surfaces, including finished base interiors enclosed by doors. Polished welds shall match original finish and grain, unless otherwise specified.
b. Grind smooth all cut or sheared edges of metal so they are free of snags and burrs.
c. All surfaces shall be checked over, after installation is completed, and polished where needed to give final full finish to job.

6. Sealants:

a. Provide sealant at all joints 3/8" or less between all stationary (fixed, without casters) equipment surfaces abutting adjacent walls or equipment. Seal the perimeter of all floor mounted, non-mobile equipment, to the floor to prevent hiding places for vermin. Interior corner joints shall form a sanitary cove of not less than 1/4". Prep. and prime surfaces as required by the manufacturer for sealant adhesion. Installation shall be a uniform, smooth continuous concave ribbon without voids and irregularities. Per sealant manufacturers recommendations, provide backer rods. Non-portable or non-movable counter top equipment without legs shall be sealed to the countertop. Any joints or portions there of exceeding 3/8" shall be covered for its entire length by a Stainless Steel closure of a design approved by the Food Facilities Consultant.

7. Metal Tops:

a. Material;

1) Top / backsplash / back splash ends / sinks shall be Stainless Steel.
2) Top under bracing; shall be Stainless Steel.

b. Metal top shall be 14 ga.

1) On flat top tables, unless Item specification differs, turn all exposed edges straight down 1-1/2" on 90deg. angle, with 1/2" toe-in on 30deg. angle.
2) On tables with sinks, unless Item specification differs, table edges shall have 3/4"H. inverted "V" edge with vertical turndown for 1 1/2" with 1/2" toe-in on 30deg. angle.
3) Adjacent to walls or other non-mobile taller equipment, provide splashes of height and width specified, 14 gauge and integral with top. Provide 2" wide splashes unless Item specification differs. Slope splash top back on an upward 45deg. angle to adjacent walls or equipment, where shown. At walls or taller equipment, turn splash top down 90deg. for 1/2" on the back unless Item specification differs. Provide 18 ga. S/S "Z" clips, secured to walls, to engage 1/2" backsplash turn down and hold backsplash to wall. All vertical and horizontal corners at splashes or turn-ups shall

be coved on 1/4" R. No solder fillets allowed. Fully weld fillers into exposed open splash ends.

4) Under brace the top with 1" x 4" x 1" channel or 1-1/2" x 1-1/2" angles, both lengthwise and widthwise 18" O.C. Stud bolt under bracing to top.
5) Seal splash top, back edges to walls and adjacent non-mobile equipment.
6) Sound deaden the top.
7) Provide Drawers, Can Opener mounting areas, Cutting Board Racks, electrical receptacles, etc. per standards when specified by a specific Item.

c. When sinks are specified integral to the Metal Top, construct sink as follows;

1) With all bowl vertical and horizontal corners coved on 1" R.
2) No solder or caulked fillets allowed.
3) Sink bowl bottom creased/sloped to drain to provide complete drainage of sink. At drain valve location, sink bottom ferruled downward to allow installed drain valve grate to set flush to or below plane of sink bottom.
4) 14 ga. S/S "L" bracket stud bolted to bottom of sink bowl to support drain twist action handle.
5) Punch splash top, deck or splash face for trim as specified. Faucets centered over sink compartment or centered over partitions if multi-compartment sink.
6) Provide sink underside with smooth 1/16" thick coat of sound deadening mastic, painted aluminum.
7) Integral sinks shall be continuously welded into the metal top, ground smooth and polished. Backsplash, Metal Top and base as specified for the specific item.

8. Dish Table Tops:

a. Materials;

1) Dish Table Top / backsplash / back splash ends / rolled rims / sinks shall be Stainless Steel.
2) Dish Table Top under bracing shall be Stainless Steel.

b. Dish table top shall be 14 ga.

1) All exposed edges shall be turned straight up 3" high with 1-1/2" semi-rolled rim, terminate at back splash and weld thereto. Rolled rim shall have spherical corners.
2) Turn down into dish machine in a water tight manner per the dish machine manufacturers recommendations.
3) When top is adjacent to walls, it shall be turned straight up 8" and back 2" on 45deg. angle, unless Item specification differs. Turn splash top down 90deg. for 1/2" on the back unless Item specification differs. Provide 18 ga. S/S "Z" clips, secured to walls, to engage 1/2" backsplash turn down and hold table to wall. Cove vertical and horizontal corners on 1/2" R. No solder or caulked fillets allowed. Fully weld Stainless Steel fillers into exposed open splash ends. Seal splash top, back edges to walls. Provide holes in back splash and top for fittings and fixtures as required.
4) Under brace dish table top with 1" x 4" x 1" channel or 1-1/2" x 1-1/2" angles both

lengthwise and widthwise 18" O.C. Stud bolt under bracing to top. Top shall be sound deadened.

9. Open Frame Base:

    a. Materials;

        1) Legs / crossrails shall be Stainless Steel.
        2) Leg Gussets; Component Hardware model A18-0206, or approved equal, 300 series x 16 ga.; set-screw style; 3-1/2"H. die-stamped round fully enclosed straight body.
        3) Bullet Feet; Components Hardware model A10-0851, or approved equal, 1-1/4" adjustable Stainless Steel clad hex bullet feet.
        4) Flanged Feet; Component Hardware model A10-0854 Stainless Steel 1-1/8" adjustable flanged feet with mounting holes, set in sealant and expansion anchored to the floor.

    b. Provide bases with 1-5/8" x 16 ga. uprights/legs and crossrails.

        1) Crossrails at rear and ends unless Item specification differs.
        2) Fully weld cross rails to uprights.
        3) Uprights shall be fitted at top with Leg Gussets and at bottom with Bullet Feet unless Item specification differs.
        4) On island table legs and on legs which are not braced from Two (2) perpendicular directions by crossrails, cabinet base or undershelf, provide Flanged Feet with mounting holes, set in sealant and expansion anchored to the floor.
        5) Weld leg gussets to top under bracing.
        6) Spans between legs shall not exceed 6'-0".
        7) When open frame base and cabinet base are both used under equipment top, terminate cross rails at cabinet body and securely anchor to body framework.
        8) Cross rails shall not occur in front of serviceable / movable / mobile items such as sinks, floor sinks, food waste collectors, waste barrels, ingredients bins.

10. Electrical Receptacles:

    a. Materials; Exposed electrical receptacle boxes shall be constructed of aluminum or fabricated Stainless Steel with smooth exterior (no exposed knockouts). Electrical conduits occurring above metal tops shall be hidden from view.

        1) Vertical Tombstone Receptacle Box; Component Hardware Group Inc. model no. R58-1010, or equivalent, single faced cast aluminum tombstone electrical outlet box with brushed satin finish and ground screw. At under counter locations, drill the back of the tombstone/box for a 1/2" I.P.S. adapter. Receptacle device and cover plate provided by other trades.

    b. Under Top;

        1) Where shown at the end of tables, enclose/box-in a 4" x 4" x 1"H. section of the

leg/metal top under bracing channel with 16 ga. S/S. Bolt to the enclosure and faced outward, a fabricated 16ga. Stainless Steel or Vertical Tombstone Receptacle Box. Receptacle device and cover plate provided by other trades.

2) Outlet box shall occur inside drawer enclosures when shown adjacent thereto.

c. Elevated Shelf Bottom; Elevated Shelf Bottom; As detailed and where shown, enclose/box-in a 4" x 4" x 1"H. section of the shelf underbracing channel with 16 ga. S/S. Bolt to the enclosure and faced, as shown, a fabricated 16ga. Stainless Steel or Vertical Tombstone Receptacle Box. Provide access for concealing feed wire conduit thru shelf supports and securing conduit below shelf in a concealed manner. Receptacle device and cover plate provided by other trades.

11. Enclosed Cabinet Bases:

a. Materials;

1) Exterior cabinet base sides, fronts, backs, ends, drawer fronts shall be Stainless Steel.
2) Internal cabinet base bracing, cabinet bottom Stainless Steel.
3) Cabinet Legs; Component Hardware model A48-5048, 6" high, 2000 lbs static load rating, 300 series Stainless Steel legs with #4 finish; hex adjustable Stainless Steel bullet feet and 3-1/2" square Stainless Steel removable mounting plate.

b. Construct of 18 gauge stainless steel enclosed on both sides, back and bottom. Cabinet body of welded construction free of screws and bolts.

1) Brace body at top with 14 gauge stainless steel 1" x 4" x 1" channel or 1-1/2" x 1-1/2" angles.
2) Ends shall terminate at exposed sides in a vertical 2" wide mullion. Below top at front, a 3"H. horizontal mullion shall extend down from Metal Top (partially hidden behind Metal Top turndown edge).
3) 16 ga. bottom shelf turns up 1 1/2" x 90deg. to inside of sides / partitions and back, welding thereto. Bottom shelf turns down at cabinet front 2" with 1" x 90deg. return. Mount cabinet body on Cabinet Legs bolted to 12 gauge stainless steel gussets, which in turn are welded to body. S/S legs shall provide a 6"H. toe space below the cabinet. Spans between legs shall not exceed 6'-0".
4) Fully weld flush and polish all seams on face of base front horizontal and vertical mullions.
5) Provide Drawers per standards when specified by a specific Item.

12. Drawers:

a. Materials;

1) Provide, as detailed, drawer fronts fabricated of 14 ga. Stainless Steel drawer faces with 1/4" radius corners and full width, 1" x 1" inverted channel style pull at drawer face top.
2) Stainless Steel Drawer Pans; Provide 18-8 Stainless Steel drawer pans with coved

corners; Component Hardware model S81-2020, 20" x 20" x 5"H. unless Item specification differs.

3) Drawer Slides; Component Hardware Group model S52 easily removable, heavy duty, full extension drawer slides with Stainless Steel ball bearing wheels, 14 ga. 300 S/S rails, removable positive stops, 200 lbs. rating. Installed to be self closing.

b. Provide drawers with 14 ga. S/S fronts, all corners radiused 1/4". As detailed provide at top of drawer front, full width 1" x 1" angle style pull extending 1" out from door face and angling 1" x 30deg out from the door face with 45deg mitered corners.

c. Drawers shall operate easily without binding on removable Drawer Slides. Drawer pans shall be easily removable. Install drawers to be self closing. Drawers, single under top hung and (3) tier shall be enclosed on back, both sides and bottom by 18 gauge housing (ref. Enclosed Cabinet Base standard). Cabinet and other enclosures around drawers shall be verminproof.

13. Rolled Rim Sinks:

a. Materials; All metals shall be Stainless Steel.
b. Sink shall be 14 gauge with all bowl vertical and horizontal corners coved on 1" R. No solder or caulked fillets allowed.

1) Sink bowl bottom creased/sloped to drain to provide complete drainage of sink. At drain valve location, sink bottom ferruled downward to allow installed drain valve grate to set flush to or below plane of sink bottom. 14 ga. S/S "L" bracket stud bolted to bottom of sink bowl to support drain twist action handle.
2) All exposed edges shall have continuous formed 1-1/2" x height (per Item specification) semi-rolled rim, terminating at back splash and fully welded thereto (unless Item specification differs). Exposed corners of rolled rims shall be spherical.
3) Provide integral splash(s) being 10" high (from top of rolled rim), turned back 2" with upward 45deg. slope and then straight down 1/2"(unless Item specification differs) with closed ends. Provide 18 ga. S/S "Z" clips, secured to walls, to engage 1/2" backsplash turn down and hold sink to wall.
4) Punch splash top, face and sink for faucet(s) / fittings as specified for each specific Item. Faucets centered over sink compartment or centered over partitions if multi-compartment sink.
5) Sound deaden bottom of sink bowls.

c. Construct base per Open Frame Base specification of standard.
d. Seal splash top, back edge to wall.
e. Construct drain boards for sinks of 14 ga. with all vertical and horizontal corners coved on 1/2" R. No solder or caulked fillets allowed. Drain boards shall be an integral part of the sink.

1) Exposed edges shall have continuous formed 1 1/2" x height (per Item specification), semi-rolled rim terminating at the splash and fully welded thereto. Corners of rolled rim shall be spherical. Drain boards shall be 2" deep at end and slope 1/2"to sink

2) Back splash shall be continuous / have same configuration of sink's back splash with closed ends.

14. Fittings;

a. Supply drain and faucet fittings as specified within each individual item. One consistent faucet/pre-rinse spray/hose manufacturer shall be used throughout the kitchen.
b. Faucet fittings shall be centered behind single sinks or centered over sink bowl partitions at multi-compartment sinks.
c. Provide a chrome tail piece on all drain fittings.
d. Provide 14 ga. S/S "L" bracket stud bolted to bottom of sink bowl to support drain twist action handle. Shorten twist action handles, when necessary, to be flush to front of sink bowl.

15. Removable Under Shelves:

a. Materials; Stainless Steel.
b. Shelf shall be 16 gauge, typically at 10" AFF. Construct in section sizes to allow cleaning them in dish machine. Roll edges down 1 1/2" fitting contour of cross rails, except where adjacent to walls, or other equipment then turn edge straight up 1-1/2" on 1/4" R. Turn adjacent edges of sections straight down 1-1/2" on 90deg. angle.

16. Stationary Under Shelves:

a. Materials;

1) Shelf top shall be Stainless Steel.
2) Shelf under bracing shall be 14 ga. Stainless Steel.

b. Shelf shall be 16 gauge typically at 10" AFF unless Item specification differs. All edges of under shelves shall be provided with (unless Item specification differs) 1/2" die-crimped inverted "V" shape edge turned straight down 1-1/2" with 1/2" toe-in at 30deg. except where adjacent to cabinet bodies, then edge shall be turned straight up 1-1/2" on 1/4" R. Notch shelf to closely fit legs and fully weld. Under shelves longer than 36" shall be under braced with 1" x 4" x 1", 14 gauge stainless steel channel, stud-bolted to shelf. Sound deaden bottom of shelf.

17. Vertical Cutting Board Rack

a. Provide Cutting Board Racks, as detailed, comprised of Two (2) 14 ga. S/S 1" x 2" x 2" x 22"L. "J" channels tack welded and sealed to adjacent enclosed cabinet base or tack welded to table legs, where occurs. Channel recessed 2" from the table front; bottom "J" channel at 12" AFF, top inverted "J" channel at 30.5" AFF. Each "J" channel subdivided by an internal tack welded 1" x 1" angle creating (2) 1" x 1" channels to support the cutting boards. Backs of upper channels closed to stop cutting boards from sliding through.

18. Elevated Shelves:

    a. Materials;

        1) Shelf top / double pan box supports shall be Stainless Steel.
        2) Shelf under bracing shall be Stainless Steel.

    b. Shelf tops shall be 16 ga. All exposed edges shall be turned straight down 1" with 1/2" toe-in at 30deg., unless Item specification differs. Turn edges adjacent to walls / taller items up 2" on 1/4"R. flush to surface face. Under brace shelves, as described in each specific item, with 14 ga. x 1" x 4" x 1" channel or 1-1/2" x 1-1/2" angle, stud bolted to bottom.
    c. Ends of shelves supported as described for each specific item.

19. Enclosure panels and fillers:

    a. Provide Stainless Steel enclosure panels and fillers where gaps or spaces occur at equipment tops and bodies, due to interferences or irregularities in building walls, columns, outlets, pipes, etc. and above equipment to ceiling as shown and detailed on drawings. Panels and fillers shall be attached, having all attaching devices concealed, unless food service equipment provider has received approval, in writing, for other means of attaching.

20. Exhaust ducts:

    a. Construct exhaust ducts of 20 ga. Stainless Steel, unless Item specification differs. All seams shall be air and water tight. Ducts shall join equipment or each other, in first class manner and be air and water tight at these points. Inside laps of vertical ducts shall project in direction against air flow.

2.3 LIST OF EQUIPMENT

A. Following is a detailed list of all equipment in the new food service area to be a part of this contract or provided by the owner. All electrical equipment is 60 cycle. All items utilizing electrical power shall be UL or CSA listed.

B Refer to accompanying Food Service Equipment drawings for equipment quantities and utility configurations required.

C. Use of the terms "standard", "standard construction", "specification of standard" refer to construction techniques, materials, methods and configurations specified in "Specification of Standard for Custom Fabricated or Modified Equipment" within this section.

D. Reference 1.2 - SUMMARY for terminology definitions.

E. Each model number includes the code *M112 as a suffix. This code is known as the Specifier Identification System. It is not to be removed by the dealers. Its purpose is to identify the specifier to the vendors providing the equipment in the event it is necessary to communicate questions, clarifications and comments, from prior to bid award through the final purchase. It is to be used on all correspondence including fax and e-mail when communicating with manufacturer representatives and factories.

F. Connection hose lengths specified here-in, are approx. for the anticipated stub up, stub out or rough-in location. Trade responsible for food service equipment installation shall verify utility rough-in locations and provide hoses and equipment restraints of the required length for field conditions.

G. Equivalent manufacturers, as listed in this specification, must provide equipment of similar size, configuration, construction and capability with similar utility requirements to the specified primary manufacturer allowing its use without changes to the plan, the equipment location or the plumbing / mechanical / electrical service designated within the contract documents. Listed equivalent manufacturers are responsible for verifying they comply with these requirements before submitting a bid.

ITEM NO. A1 - OFFICE FURNISHINGS
BY OWNER

ITEM NO. A2 - COPIER
BY OWNER

ITEM NO. A3 - CONFERENCE TABLE
BY OWNER

ITEM NO. A4- BREAK / CONFERENCE FURNISHINGS
BY OWNER

ITEM NO. A5 - TOP FREEZER - REFRIGERATOR; 21 C. F.
REQUIRED

A. Provide General Electric model GTS22SBXSS*M112 Overall 35"W x 33 5/8"D x 67 1.2"H. Upfront temperature controls - Easy-to-use controls regulate both fresh food and freezer sections; adjustable spillproof glass shelves - raised edges; snack drawer; adjustable-humidity drawers; adjustable gallon door bins; wire freezer shelf; reversible door hinging; stainless steel.

1. Reverse the door hinging to be left hinged.

ITEM NO. A6 -OVEN; MICROWAVE

REQUIRED

A. Provide ACP model RMS10TS*M112, 1000 watts, low volume commercial microwave oven; overall 20"W. x 16 1/4"D. X 12-1/4". Interior 13"W. x 13"D. x 7-3/4"H.; 10 touch pad control panel programmable with up to 20 menu items; Braille; 60 minute countdown timer for all power settings with a time entry option and an end of cycle audible signal; LED display; 5 power levels and 3 cooking stages; 1000 watt output distributed by one bottom feed magnetron rotating stirrer; door having tempered glass window and grab and go handle with a +90deg. opening; interior light; 0.8 cubic ft. cavity accommodates a 12" (305 mm) platter; stainless steel exterior wrap and stainless steel interior.

ITEM NO. A7 -CABINETRY; DOOR BASE
BY OTHER TRADES

ITEM NO. A8 - SINK; DROP IN
REQUIRED

A. Provide Advance / Tabco model DI-1-10*M112, drop in self rim sink, overall 10"W. x 14"D. with 10"H. bowl. 20 gauge 304 series S/S. with deck mounted gooseneck faucet, 2" coved interior bowl corners; all seams TIG-welded and blended to match satin finish sink bowls; 1-1/2" basket type S/S drain for 3-1/2" bowl drain hole. Provide with the following;

1. Model K-55, Deck Mounted 8 1/2" Gooseneck faucet with 4" O.C. valves.

ITEM NO. A9 -ICE MAKER DISPENSER; NUGGET STYLE
REQUIRED

A. Provide Follett model 25CI425A-L*M112 Symphony Plus™ Ice & Water Dispenser; overall 21"W. x 24"D x 36"H. Countertop; lever dispense; top mounted integral icemaker; automatic load, nugget style, air-cooled condenser, 425 lb. production/24 hours, 25 lb. storage capacity, stainless steel exterior; glass filler. Provides Chewblet compressed nugget chewable ice; air cooled R404A icemaker is removable for cleaning and maintenance; side air intake - top exhaust air movement; quiet production without noisy harvest cycles; infrared sensor controlled water and ice dispensing action; stainless steel evaporator and auger; stainless steel dispenser frame; stainless steel cabinet with plastic trim; printed circuit board with diagnostics; storage area insulated with high density, non-CFC foam polyurethane; ice machine turns off when idle; automtic self-flushing; internal air gap; 1 hour cleaning and sanitizing; LED control board shows machine status; secured top lid. 7' cord.

1. Provide Follett Water Filter kit model 00130229. Mount filter in base cabinet below.

ITEM NO. B1 - LOCKERS; (6) STACK 12" X 15" BOX
REQUIRED

A. Provide SPG International / Kelmax model 4K0091*M112 - (6) tier lockers; 12"W. x 15"D. x 72"H. 16 gauge door and frame, rear legs, lock clips; 20 gauge top, bottom, shelves, back, filler, and slope top components; 24 gauge sides. Continuous hinge; Padlock hasps standard. Powder

coat paint finish. 6” legs. Securely anchor tight to abacking wall. Provide with the following options;

1. Both sloped top and enclosed base (4K0091ESL2)

B. Lockers must fit tightly to the side and abacking walls. Do not extend wall base behind / beside the lockers. Coordinate with trade responsible for coordinating work / flooring contractor.

C. Secure to abacking wall

D. Seal base to floor.

ITEM NO. B2 - COAT ROD W/ SHELF
REQUIRED

A. Provide and mount on wall, constructed similar to standards for Elevated Shelves, a 12"D. X approx. 48"L. wall shelf with coat rod below.

1. Shelf of 16 ga. S/S.
2. Provide 1" x 90deg. turnup at ends and abacking wall.
3. Front edge having standard 1" turn down with 1/2" toe-in at 30deg.
4. Shelf supported with knife edged S/S wall support brackets configured to accept a coat rod between the supports. Supports located adjacent to shelf ends and at intermediate locations to maximize coat rod length.
5. 1-5/8" S/S coat rod at 3.25" below front edge of shelf top and continuously welded between shelf support bracket locations.
6. Securely anchored to wall with coat rod at 60" AFF.

ITEM NO. B3 -BARREL; SOILED LINEN
REQUIRED

A. Provide Rubbermaid model FG354060, 23 gallon Slim Jim® Waste Container, w/handles, overall 20"L x 11"W x 30"H. General purpose waste, open type without lid, high-impact plastic construction, gray.

ITEM NO. B4 -CLOTHES WASHER; HOME TOP LOAD
BY OWNER

ITEM NO. B5-CLOTHES DRYER; HOME FRONT LOAD
BY OWNER

ITEM NO. B6 - SHELF; WALL
REQUIRED

A. Provide and mount on wall, constructed per standards for Elevated Shelves, a 12"W. x 66"L. wall shelf, 60" above finished floor;

1. Top constructed of 16 ga. S/S.
2. Exposed front and exposed end edges having standard flat top with 1" turn down with 1/2" toe-in at 30deg.
3. Wall adjacent edges turn up 2" on 1/4"R. flush to the wall face.
4. Shelf under braced and supported with 14 ga. "Knife" tapered cantilever bottom support wall brackets stud bolted to shelf bottom, securely anchored to wall / in wall blocking.

ITEM NO. B7 -TABLE; LINEN W/ UNDER SHELF
REQUIRED

A. Provide overall 66"L. x 24"D. x 36"H. to work top. Construct per standards with Metal Top;

1. Provide staff side edge and exposed end edges with 1-1/2"x 90deg. straight turn down and 1/2" toe-in on 30deg. angle.
2. Provide with 2" H. wall flush turn-up at back and end walls.

B. Provide Open Frame Base, per standards. Provide with standard 60"L. Stationary Undershelf.

ITEM NO. B8 - CABINET; CLEAN LINEN
REQUIRED

A. Provide Lyon Metal Products Inc. model 1090*M112, 36"W. x 24"D. x 78"H. storage cabinet. Equivalent by Tennesco 7824. Shelf adjustment on 2" centers; "Quiet-Door" with three point locking; flush front, back and sides; double pan reinforcement on doors which swing full 180deg; three piece welded shelf reinforcement with 400 lbs. capacity per shelf; four adjustable shelves and fixed bottom shelf. Provide in Dove Gray. Shipped assembled.

ITEM NO. C1 -WALK IN FREEZER
REQUIRED

A. Furnish all labor, materials, and equipment for complete installation of sectional walk-in freezer unit as shown on drawings and specified herein. Shall include lights, thermometers and accessories for complete first class installation. Install compressors, refrigerant piping and refrigerant as specified.

B. Manufacturers; Specification is based on walk-in boxes as manufactured by Kolpak*M112, N.S.F. approved. Alternate manufacturers include American Panel, Norlake, Master-Bilt. Alternate manufacturers, as listed here-in, must provide equipment of exact same dimensional size, and comparable construction with similar utility requirements to the walk-in box manufacturer on which this specification is based. Use of equivalent manufacturers equipment shall not require changes to the plan, the equipment location or to plumbing / electrical service designated within the contract documents. Listed Equivalent manufacturers are responsible for verifying they comply with these requirements before submitting a bid.

C. Walk-in freezer shall comply with the Energy Independence & Security Act of 2007.

D. Design Layout and Overall Size; Walk-in unit as shown on plans and as specified. Shall be

overall size 21'-0"wide x 19'-0" deep x 9'-0" high from exterior top to bottom of wall panels. Unit shall be installed on a recessed floor/slab furnished by General Contractor, see detail on drawings.

E. Building Constraints; Provider of walk-in is required to field measure locations of walls / columns and other building constraints and provide walk-in to fit such conditions. Notify architect / food facility consultant if box size must be reduced due to obstructions.

F. Floor; As detailed, walk-in wall panels extend to the bottom of an 8" recessed floor pit (By Other Trades). Floor is built up (By Other Trades), with (2) layers of 2" urethane insulation and 4" reinforced concrete wear surface over the top. Interior of slab recess having 6 mil. polyethylene vapor barrier to warm side of insulation and panels. Provide visquene on interior of wall panels to 48" AFF to protect panels during pouring of interior slab. Bottom layers of urethane insulation laid atop slab vapor barrier. Joints in bottom layer of insulation lapped a minimum of 12" by top layer of insulation. All joints in insulation butted tight. Door(s) into walk-in compartment removed and interior space ventilated with fans while floor slab is poured and curing. Interior floor slab flush to adjacent space floor at door and separated from it as detailed. Flush in floor heated threshold inset to slab below doors, as shown. Floor slab having lightly brushed top surface and sealed. Cut off vapor barrier and interior wall protection visquene at top of cured slab and calk interior perimeter of slab to wall panels with low temperature sealant.

1. As detailed, holes are required in the sub slab, sub slab heat tape and sub grade ventilation / drainage tubes are required (By Other Trades as shown and per the box manufacturers recommendations.

G. Walls & Ceiling; Construct all exterior and interior surfaces of .040" stucco patterned aluminum, insulate walk-in throughout, with 4" foamed-in-place, rigid U.L. fire rated, flame retardant type polyurethane insulation sandwiched in between. Polyurethane insulation shall meet ASTME-84 flame spread of less than 25. Minimum "R" factor of 32 for both refrigerator and freezer. Insulation shall be blown using a non-CFC content blowing agent. Construct panel sections without internal wood or metal structural members and with 100% (excluding skins), polyurethane insulation. Provide 90deg. angled sections at all corners. Food service contractor shall provide penetrations thru insulated cabinet exterior & is responsible for sealing them.

1. Provide verification, as required by the code authority, that the box complies with the code requirements for use of foam plastic insulation in buildings and structures. Cost of the verification to be borne by the provider of the walk-in box.
2. Sections are fitted together with mating tongue and groove panel perimeters having thermoplastic hooded gaskets at interior and exterior edges. Provide non-conductive strip, in all exterior sections, at joints where partitions butt. Sections fasten together with quick acting cam, "Posi-Loks". Access ports to cam-locks shall be on interior. Spacing between fasteners on vertical joint shall not exceed 45", at vertical to horizontal joints and horizontal joint, 23". Cover all cam fasteners wrench holes, with thermoplastic press-fit caps.
3. On all exterior exposed-to-view walk-in box panels, provide a 36"H. wainscot of .188 - 6061-T6 mill finish aluminum tread plate, mechanically secured and sealed thereto.
4. As detailed, wall panels set in female bottom rail in bottom of floor slab recess. Wall panels spaced out 2" from recessed floor pit, as detailed, by other trades.

H. Provide pressure relief port in freezer wall located at and per box manufacturers recommendations. Provide oversized relief port where appropriate for box size. Factory-wire relief port to J-box at door section, when possible.

I. Hinged Door; Shall be 36" x 78". Construct door exterior with 22 ga. stainless steel, interior of same material as interior walls. Door frame with alarm and light management controls. Doors shall be infitting flush type and with insulation same thickness and material as wall sections. Fiberglass Reinforced Plastic door perimeter, jamb and threshold. Heavy duty cast alloy door handle and hinges with powder coat finish. Three (3) positive action self-closing hinges with stainless steel pin and nylon rising cam bearing. Provide thermoplastic gasket with magnetic core at door top and both sides and adjustable sweep gasket at door bottom edge. Provide heater wires around perimeter of door opening and door. Factory-wire heater wires to J-box at door section. Hinge doors as shown on plan.

1. When a concrete wear surface is shown poured inside walk-in box, provide heated threshold secured flush in finished floor at entry door and extended height door frame(s) to allow for concrete wear surface and threshold. Ref detail.
2. Provide hinged doors with automatic door closers that firmly close doors when shut to within 1 inch of full closure. Hinged Doors shall self close. Hinge door as shown.
3. Provide flush in floor heated threshold at all hinged and sliding entry doors.
4. Provide hinged doors with spring loaded, positively closing door hinges.
5. Provide (3) hinges per door.
6. Door Handle; Kason 0027C Door Handle with inside release.
7. On the exterior of the door section, adjacent to the door latch side, provide a box for the walk-in digital thermometer & light management system. Control is pre-wired to a junction box & wall light fixture at the interior latch side upper corner of the door opening; wiring in conduit concealed within the insulated panel.
8. In addition to digital thermometer, provide door section with exterior, flush mounted, 4-1/2" diameter N.S.F. listed chrome plated dial thermometer.
9. Provide a window in hinged doors. Minimum 14" x 14" window. Freezer door window shall be of triple pane glass with either heat-reflective treated glass or gas fill with heated frame. Refrigerator door(s) window shall be triple pane glass with heat-reflective treated glass or gas fill. Window shall be field replaceable. Window centered at 60" aff.

10. Provide hinged door with an interior mounted thermo-plastic, insulating swing door.

    a. Provide Cool Curtain PVC Swinging Door. (2) leaf overlapping bi-swinging doors constructed with .125 clear non-stick PVC; auto close gravity hinge requiring less than 1lb pressure; stainless steel springs, fasteners, rod and bearings; 10 year anti-rust warranty on hinge system; for use in coolers or freezers. PVC Swinging Doors sized for the designated openings as recommended by the manufacturer. Door installed so as not to pinch heater wire for glass window in entry door.

11. On exposed-to-view exterior and interior of hinged walk-in doors, provide 36"H. wainscots constructed of .100 - 6061-T6 mill finish aluminum tread plate. Mechanically secure tread plate to door and seal thereto.

J. Sliding Door; Where shown, provide a Jamison Mark IV Model ADS-201*M112 single leaf horizontally sliding freezer door with Diamond Trac System; overall opening size - 60"W. x 84"H. Door leaf to have aluminum extruded structure and 26 ga. white painted stucco embossed steel front and back. White painted aircraft quality aluminum header and frame casings; door insulated with non-CFC polyurethane insulation; aluminum track with bearing wheels; door track and guides provide positive seal on closing; polyester reinforced adjustable gasket at side and head of frame; sweep type floor gasket; corrosion protected door hardware; five year warranty on door and track. Inside safety release required on all doors with any means of latching / locking mechanism. Freezer door with Frostop heater cables in top, sides and bottom of door and (3) sides of frame.

1. Provide padlocking provisions on front of door with safety release from inside of freezer box.
2. 12" x 14" 3-pane heated viewport with heated glass and frame heater.
3. Provide tread plate wainscot both sides - 36"H

K. Provide sliding door with an interior mounted thermo-plastic, insulating curtain. Provide reinforcing on interior of walk-in box above the walk-in sliding door; for mounting of a strip curtain. Provide Cool Curtain Extra Flex Tuf-Flex overlapping strip curtain. Curtain comprised of 12"W., .12 mil flexible clear polyClear PVC strips with (3) ribs each side to resist abrasion and fork lift traffic. Slightly tinted, rounded edges, non toxic, non porous and remains soft and pliable in freezer cold storage applications, unaffected by large temperature differentials on opposing sides of the curtain. Mount curtain with G series mounting; inverted aluminum "Y" mounting bar which bolts to reinforcing above the entry door. Curtain strips slide into aluminum mounting bar for easy replacement. Curtain width and height as required for the mounting method and side overlap as recommended by the manufacturer. Door opening 60"W. X 84"H.

L. Interior lighting;

1. At junction box / light fixtures on the interior latch side upper corner of the door opening, provide a Kason 1806 LED fixture with lamp and Optic Globe or comparable. 980 Lumens; 5000K color temperature; 50,000 hr. rated life; -40 to 70deg. F. operating range; 11.5W at 120V.; Lexan globe with light intensifying focused optics; aluminum housing; 5 year limited fixture warranty; 3 year limited lamp warranty; NSF listed, cULus listed.
2. Supply for installation (By EC) in each compartment, Six (6) Kason Industries model 1810 LED light fixtures; overall 49-7/8"L. X 6-7/32"W. X 4-7/32"H. Lumanaire rating IP-65 for wet and cold environments; constructed of heavy gauge injection molded polycarbonate with integrated gasket; clear molded shatterproof high impact polycarbonate diffuser with (8) stainless steel latches; , 8 supplied per fixture; two E-Z mount brackets; 2-Lamp x 18w at 1200 lumens each; 67 lumens/watt - exceeds Federal Energy Act requirement; bright 5000K color temperature; 50,000 hr life; 5-year limited warranty on fixture; 3-year limited warranty on lamps; listed cULus & NSF; NEC & RoHS compliant; specifically designed for wet and low temperature environments; 36 Watts, 0.3 AMPS, 120V; Ideal operating temperature range from -40F to 70F (-40C to 21C)

M. Provide Cooper Atkins Notifeye cloud based monitoring & notification system (Equivalent by SmartTemp). Features - Basic Sensor Configurations available include Sensor Name, Set Heartbeat, Select Unit of Measurement; Advanced Sensor Configurations available include

Recovery Attempts, Inactivity Alerts, Sub-heartbeat Assessments; sensors configurable by group; sensors may be grouped by gateway, type or status; supports unlimited number of networks, sensors, gateways and users; network overview dashboard provided; on-screen alerts and notifications to a single user or multiple recipients; data is accessible via the Internet; notifications sent via email and SMS Text; permission-based access control and reporting; a sensor mapping (visual placement) tool; list of recent alerts for each sensor; sensor history storage; sensor data history reports, visual charts with export available. Provide the following components;

1. Provide One (1) Cooper Atkins NotifEye™ Ethernet Gateway model 15501*M112, to allow wireless sensors to communicate with the online monitoring and notification system without the need for a computer. 900 MHz communication range; minimum system requirements: internet access via an Ethernet Port, PC or MAC compatible.
2. Provide Three (3) Cooper Atkins NotifEye™ Temperature Sensors model 15100*M112, to monitor temperature and send data via gateways to the NotifEye system. Install, per manufacturers recommendations, one sensor in each the Freezer room 113, Refrigerator room 114 and Cold Hold room 122. 250 to 300 ft wireless range; -40 degree to 257degree F (-40degree to 125degree C) temperature range; RF 900 MHz communication range; replaceable 3 Volt lithium ion coin cell battery with typ. 2-3 year life based on 2 hour heartbeat.
3. Install system per manufacturers recommendations, test / verify operation. Provide owner demonstration of capabilities and help owner with initial setup.

N. Ceiling Span; Structurally design ceiling sections to span area shown, without dip or bulge, in horizontal planes and provide exterior ceiling suspension beams where required.

1. Where shown and per manufacturers details/recommendations, provide suspension for the ceiling panels. Ceiling hangar brackets, secured at Posi-Loc locations, are bolted to horizontally run angles which are hung, by hangar straps, from structure above. Hangar brackets and horizontally run angles/channels are by FSC, hangar straps/rods are by other trades. Anchoring method for hangar straps/rods to structure as approved by structural engineer. Hangar straps / rods at 48"O.C. max. Each hanger carrying approx. 225 lbs of dead load to support the ceiling panels.

O. Vertical Trim; provide vertical trim; angle/flat strips and closures of same material and gauge as walk-in exterior wall surface(s), where walk-in is adjacent to interior or exterior walls, jambs and/or columns. Crimp all angle trim strip edges down slightly, to hug adjacent surfaces. Attach trim strips with 1/8" aluminum pop rivets, using only minimum required number to give neat installation.

P. Filler Panels; Provide filler panels, of same material and gauge as walk-in exterior wall surface, at exposed edges of walk-in top, as detailed, to finish ceiling. Filler panels shall align with adjacent panels and extend full length of box plus wall closure trim; shall fit tightly within ceiling and box face mounted channels; all edges / surfaces aligned without gaps / tin-panning / irregularities in appearance; closed outside corner trim at outside corners.

ITEM NO. C2 - BUMPER RAIL; FLOOR MOUNT

REQUIRED

A. Provide Alvarado Brass model SSB*M112 removable stainless steel bumper system for wall and case protection. All components are stainless steel and polished to a #4 finish. SSB Rails constructed of 1.75" diameter x 16 ga. S/S tubing capped each end with force fit impact resistant plastic end cap. Top of rail at 7.125" AFF. SSB Stem which supports rail is a fully welded and ground smooth assembly constructed with a tapered 2" diameter x 4"L. S/S tube welded to the top of a 0.75" diameter x 7.5"L. stainless steel stem rod. (2) 1/4-20 set screws are provided on the underside of ea. stem tube to secure to the rails. Stem rod extends 7.75" past tube and fits smoothly into floor sockets. SSB Socket is a 0.755" I.D. x 2.5"L. S/S tube with a 1.75" diameter flange at one end and sealed at the other. Provide the following components and install per manufacturers recommendations as shown;

1. (2) - 30" SSB Rails, each including (2) SSB Stems.

ITEM NO. C3 - NOT USED

ITEM NO. C4 - WALK IN REFRIGERATOR
REQUIRED

A. Furnish all labor, materials, and equipment for complete installation of sectional walk-in refrigerator unit as shown on drawings and specified herein. Shall include lights, thermometers, and accessories for complete first class installation. Install compressors, refrigerant piping and refrigerant as specified.

B. Manufacturers; Specification is based on walk-in boxes as manufactured by KOLPAK*M112, N.S.F. approved. Alternate manufacturers include American Panel, Norlake, Masterbilt. Alternate manufacturers, as listed here-in, must provide equipment of exact same dimensional size, and comparable construction with similar utility requirements to the walk-in box manufacturer on which this specification is based. Use of equivalent manufacturers equipment shall not require changes to the plan, the equipment location or to plumbing / electrical service designated within the contract documents. Listed Equivalent manufacturers are responsible for verifying they comply with these requirements before submitting a bid.

C. Walk-in refrigerators shall comply with the Energy Independence & Security Act of 2007.

D. Design Layout and Overall Size; Walk-in unit as shown on plans and as specified. Shall be overall size 18'-5 3/4" wide x 19'-0"deep x 9'-0" high from exterior top to bottom of wall panels. Unit shall be installed on recessed floor/slab furnished by General Contractor, see detail on drawings.

E. Building Constraints; Provider of walk-in is required to field measure locations of walls / columns and other building constraints and provide walk-in to fit such conditions. Notify architect / food facility consultant if box size must be reduced due to obstructions.

F. Floor; Same As Item C1.

1. As detailed, holes are required in the sub slab, same as Item C1.

G. Walls & Ceiling; Same As Item C1.

1. Provide verification, as required by the code authority same as Item C1.
2. Sections are fitted together with mating tongue and groove same as Item C1.
3. As detailed, wall panels set in female bottom rail in bottom of floor slab recess same as Item C1.
4. On all exterior exposed-to-view walk-in box panels, provide a 36"H. wainscot of .188 - 6061-T6 mill finish aluminum tread plate same as Item C1.

H. Hinged Door same as Item C1.

1. When a concrete wear surface is shown poured inside walk-in box, provide heated threshold secured flush in finished floor at entry door and extended height door frame(s) to allow for concrete wear surface and threshold. Ref detail.
2. Provide hinged doors with automatic door closers same as Item C1.
3. Provide flush in floor heated threshold at all hinged and sliding entry doors.
4. Provide hinged doors with spring loaded, positively closing door hinges.
5. Provide (3) hinges per door.
6. Door Handle; Kason 0027C Door Handle with inside release.
7. On the exterior of the door section, adjacent to the door latch side, provide a box for the walk-in digital thermometer & light management system same as Item C1.
8. In addition to digital thermometer, provide door section with exterior, flush mounted, 4-1/2" diameter N.S.F. listed chrome plated dial thermometer.
9. Provide a window in hinged door. Minimum 14" x 14" window. Window shall be have triple pane glass with heat-reflective treated glass or gas fill. Window shall be field replaceable. Window centered at 60" aff.
10. Provide hinged door with an interior mounted thermo-plastic, insulating swing door same as Item C1.
11. On exposed-to-view exterior and interior of hinged walk-in doors, provide 36"H. wainscots same as Item C1.

I. Sliding Door; Where shown, provide a Jamison Mark IV Model ADS-201*M112 single leaf horizontally sliding refrigerator door with Diamond Trac System; overall opening size - 60"W. x 84"H. Door leaf to have aluminum extruded structure and 26 ga. white painted stucco embossed steel front and back. White painted aircraft quality aluminum header and frame casings; door insulated with non-CFC polyurethane insulation; aluminum track with bearing wheels; door track and guides provide positive seal on closing; polyester reinforced adjustable gasket at side and head of frame; sweep type floor gasket; corrosion protected door hardware; five year warranty on door and track. Inside safety release required on all doors with any means of latching / locking mechanism.

1. Provide padlocking provisions on front of door with safety release from inside of freezer box.
2. 12" x 14" 2-pane viewport.
3. Provide tread plate wainscot both sides - 36"H.

J. Provide sliding door with an interior mounted thermo-plastic, insulating curtain same as Item C1.

K. Interior lighting;

1. Provide, for field installation where shown, Six (6) Kason Industries model 1810 LED light fixtures, same as Item C1.

L. Ceiling Span; Structurally design ceiling sections to span area shown, without dip or bulge, in horizontal planes. Where shown and per manufacturers details/recommendations, provide suspension for the ceiling panels same as Item C1.

M. Vertical Trim; Provide same as Item C1.

N. Filler Panels; Provide same as Item C1.

O. Mount Cooper Atkins Notifeye sensor per manufacturers recommendations; ref. Item C1.

ITEM NO. C5 -BUMPER RAIL; FLOOR MOUNT
REQUIRED

A. Provide Alvarado Brass model SSB*M112 removable stainless steel bumper system for wall and case protection, same as Item C1.

ITEM NO. C6 -COMPRESSOR; -10 FREEZER
REQUIRED

A. Furnish all labor, materials, and equipment for complete installation of walk-in freezer refrigeration system. Shall include time clock, expansion valve(s), solenoid valve(s), temperature control, sight glass, drier, head pressure control, crankcase heater, anti-sweat heater, cables, pilot light, evaporator(s), pre-charged outside condensing unit, accessories and all other required parts and refrigeration specialties for complete first class installation. Refrigerant shall be in compliance with the Montreal Protocol for reduced CFC content; freezer using R-404A. Install compressor, refrigerant piping and refrigerant as specified, hereinafter. See Refrigeration Requirements sub section of this specification section. Equivalent manufacturers must provide equipment of similar dimensional size, and comparable construction and same or higher BTU refrigeration capacities with similar utility requirements to the refrigeration system on which this specification is based. Use of equivalent manufacturers equipment shall not require major changes to the plan, the equipment location or to electrical service designated within the contract documents. Any minor changes required are the responsibility of the provider to coordinate with other trades and all costs associated with changes shall be covered by the provider. Listed Equivalent manufacturers are responsible for verifying they comply with these requirements before submitting a bid.

1. Provide Kolpak Industries pre-fitted remote refrigeration system for remote installation and as located on drawings, including all standard parts, refrigeration specialties, factory sized refrigeration lines, electric defrost for freezer, chre charged air cooled condensing unit(s), with weather-proof covers and low ambient kit/winter controls using head pressure control

valves and other items necessary for a complete and properly operating system. Hang evaporators with double nutted nylon bolts. Units on racks at least 4" above roof / slab. Provide (5) year compressor warranty.

2. Provide Freezer Item No. C1 with Kolpak Industries Model PC-449-LZOP-3, pre-fitted/pre-refrigerant charged remote Scroll R404A refrigeration system with 4.5 horsepower condensing unit and Two (2) EL26-92-2EC-PR-4 evaporators with electric defrost for freezer to operate at -10degF.
3. Walk-in freezer compressor shall comply with the Energy Independence & Security Act of 2007.
4. Weather proof cover shall include a hail screen.

B. Condensing units shall be set on the roof top above the walk-in location, set on curbs provided by other trades.

C. Extend evaporator condensate drain lines as shown. Extend drain lines with copper tubing having minimum diameter of 5/8" radius per manufacturers recommendations. Run lines as shown with minimum slope of 1/4" per foot. Condensate lines, wrapped with electric heater wires and insulation to prevent freezing of condensate. Provide heat tape with integral 30mA nominal ground fault equipment protection circuit interrupter. Heat tape and insulation by Food Service Contractors. Connect heater wires to power supply at evaporator.

D. It is the intention of this specification for a complete refrigeration system, including all refrigeration specialties and all other parts, devices and accessories required for a complete and properly functioning system, furnished and installed whether or not each item is specifically mentioned in the specifications.

ITEM NO. C7 -COMPRESSOR; + 35 REFRIGERATOR REQUIRED

A. Furnish all labor, materials, and equipment for complete installation of walk-in refrigerator refrigeration system. Shall include expansion valve, solenoid valve, temperature control, sight glass, drier, head pressure control, crankcase heater, anti-sweat heater, cables, pilot light, evaporator, pre-charged out door condensing unit, accessories and all other required parts and refrigeration specialties for complete first class installation. Refrigerant shall be in compliance with the Montreal Protocol for reduced CFC content; refrigerator using R-404A. Install compressor, refrigerant piping and refrigerant as specified, hereinafter. See Refrigeration Requirements sub section of this specification section. Equivalent manufacturers must provide equipment of similar dimensional size, and comparable construction and same or higher BTU refrigeration capacities with similar utility requirements to the refrigeration system on which this specification is based. Use of equivalent manufacturers equipment shall not require major changes to the plan, the equipment location or to electrical service designated within the contract documents. Any minor changes required are the responsibility of the provider to coordinate with other trades and all costs associated with changes shall be covered by the provider. Listed Equivalent manufacturers are responsible for verifying they comply with these requirements before submitting a bid.

1. Provide Kolpak Industries pre-fitted remote refrigeration system for remote installation as located on drawings, including all standard parts, refrigeration specialties, factory sized refrigeration lines, pre-charged air cooled condensing unit, with weather-proof cover and low ambient kit/winter controls using head pressure control valves and other items necessary for a complete and properly operating system. Hang evaporator with double nutted nylon bolts. Provide (5) year compressor warranty.
2. Provide Refrigerator Item No. C4 with Kolpak Industries Model PC199MZOP-3, remote Scroll R404A pre-fitted/pre-refrigerant charged refrigeration system with 2 horsepower condensing unit and AM46-192-1EC-PR-4 evaporator coil for refrigerator to operate at 35degF.

3. Walk-in refrigerator compressor shall comply with the Energy Independence & Security Act of 2007.
4. Weather proof cover shall include a hail screen.

B. Condensing units shall be set on the roof top above the walk-in location, set on curbs provided by other trades.

C. Extend evaporator condensate drain as shown. Extend drain line with copper tubing having minimum diameter of 5/8" radius per manufacturers recommendations. Run line as shown with minimum slope of 1/4" per foot.

D. It is the intention of this specification for a complete refrigeration system, including all refrigeration specialties and all other parts, devices and accessories required for a complete and properly functioning system, furnished and installed whether or not each item is specifically mentioned in the specifications.

ITEM NO. C8 - WOOD PALLET
BY OWNER

ITEM NO. C9 - PLATFORM TRUCK; CENTER PIVOT
REQUIRED

A. Provide L.K. Goodwin Co., model PH148-P9 reinforced 6 wheel platform trucks; overall 18"W. x 48"L. x 48"H. All welded construction; 12 ga. steel platform with 1 1/2" turndown lip all sides - 3000 lbs capacity; 1-1/4" removable tubular handle each end; (6) - 5" x 2" phenolic casters - center (2) fixed - (4) swivel at ends; 9"H. platform; tilt feature for center pivoting; powder coat gray finish.

ITEM NO. C10 - DUNNAGE; 2-TIER T-BAR
REQUIRED

A. Provide New Age Industrial all welded aluminum T-Bar series shelving *M112. Two shelf unit; Vertical legs and shelf perimeters are 1 1/2" x 1 1/2" x .070" wall tubing; front to back shelf laterals are 1 1/4" x 2 1/4" x .100" wall T-Bar; adjustable feet; 1,000 lbs capacity each shelf; NSF. Life time guarantee against rust, corrosion, workmanship and material defects. Provide the following models;

1. C10A - Five (5) model 1031TB, 42"W. x 24"D. x 48"H.
2. C10B - Four (4) model 1026TB, 48"W. x 24"D. x 48"H.
3. C10C -Two (2) model 1025TB, 36"W. x 24"D. x 48"H.

ITEM NO. C11A - DUNNAGE RACK; 1 TIER POLYMER
REQUIRED

A. Provide a Metro model HP2230PD*M112 dunnage rack; overall 22" x 30" x 12"H. Rotationally molded grey polyethylene construction with front to back slotted tops; generously radiused edges; 1,500 lbs. capacity; polymer "Bow" ties which fit top recesses for joining racks in "end-to-end" and "back-to-back"; ties removable w/o tools.

ITEM NO. C11B - DUNNAGE; (1) TIER POLYMER
REQUIRED

A. Provide a Metro model HP2236PD*M112 dunnage rack; overall 22" x 36" x 12"H. Rotationally molded grey polyethylene construction with front to back slotted tops; generously radiused edges; 1,500 lbs. capacity; polymer "Bow" ties which fit top recesses for joining racks in "end-to-end" and "back-to-back"; ties removable w/o tools.

ITEM NO. C11C - DUNNAGE; (1) TIER POLYMER
REQUIRED

A. Provide a Metro model HP2248PD*M112 dunnage rack; overall 22" x 48" x 12"H. Rotationally molded grey polyethylene construction with front to back slotted tops; generously radiused edges; 3,000 lbs. capacity; polymer "Bow" ties which fit top recesses for joining racks in "end-to-end" and "back-to-back"; ties removable w/o tools.

ITEM NO. C11D -DUNNAGE; (1) TIER POLYMER
REQUIRED

A. Provide a Metro model HP2260PD*M112 dunnage rack; overall 22" x 60" x 12"H. Rotationally molded grey polyethylene construction with front to back slotted tops; generously radiused edges; 3,000 lbs. capacity; polymer "Bow" ties which fit top recesses for joining racks in "end-to-end" and "back-to-back"; ties removable w/o tools.

ITEM NO. C12 - SHELVING; EPOXY WIRE
REQUIRED

A. Furnish, assemble and set in place, the following stationary storage system shelving, as manufactured by Intermetro Industries Corp*M112. Shelving design and model numbers are based on Metro, Super Erecta Shelf wire shelving, Metroseal III finish with Microban antimicrobial protection, with 12 year limited warranty against rust formation, with all standard parts and accessories necessary for a complete installation. Units comprised of the following;

1. Each unit having 74 5/8" high posts.
2. Each unit comprised of (4) shelves. Install with shelves at 6" - 28" - 50" - 72" AFF

3. Provide "S" clips at interior corners of perpendicular setting shelves, avoiding interior corner posts.
4. C12A Two (2) unit comprised of 1848NK3 shelves, 18" x 48".
5. C12B Eleven (11) units comprised of 2442NK3 shelves, 24" x 42".
6. C12C Five (5) units comprised of 2436NK3 shelves, 24" x 36".
7. C12D Six (6) units comprised of 2448NK3 shelves, 24" x 48".

ITEM NO. C13 - SHELVING; CHROME WIRE
REQUIRED

A. Furnish, assemble and set in place, the following stationary storage system shelving, as manufactured by Intermetro Industries Corp*M112. Shelving design and model numbers are based on Metro, Super Erecta Shelf wire shelving, chrome finish, with all standard parts and accessories necessary for a complete installation. Units comprised of the following;

1. Each unit constructed with 74 5/8" high posts.
2. Provide each unit with (4) shelves. Install with shelves at 6" - 28" - 50" - 72" AFF.
3. Provide "S" clips at perpendicular setting shelving to avoid posts located in interior corners.
4. C13A - Seven (7) unit comprised of 2442NC shelves, 24" x 42".
5. C13B - Three (3) units comprised of 2448NC shelves, 24" x 48".

ITEM NO. C14A - UTILITY CARTS; 3 SHELF -650 LBS CAP
REQUIRED

A. Provide Lakeside Model No. 722*M112, 650 lbs. capacity, 3 shelf, overall 19-3/8" W. x 32-5/8"L. x 34-1/2"H., 18" x 27" shelf size, all stainless steel, 1" x 1" x 1/8" angle legs, 18 ga. shelves, set on (2) 5" swivel casters and (2) - 8" fixed deluxe wheels.

ITEM NO. C14B - UTILITY CARTS; 2 SHELF -650 LBS CAP
REQUIRED

A. Provide Lakeside Model No. 721*M112, 650 lbs. capacity, 2 shelf, overall 19-3/8" W. x 32-5/8"L. x 34-1/2"H., 18" x 27" shelf size, all stainless steel, 1" x 1" x 1/8" angle legs, 18 ga. shelves, set on (2) 5" swivel casters and (2) - 8" fixed deluxe wheels.

ITEM NO. C15 - PALLET JACK
BY OWNER

ITEM NO. C162 -TRUCK; UTILITY
REQUIRED

A. Provide Lakeside Model No. 456*M112 Overall 24" x 48" platform size, dual handle, stainless steel platform with underbracing, heavy gauge angle steel, (4) 5" swivel casters & (2) 8" fixed casters, 1000 lb. load capacity

ITEM NO. D1 - SHELVING; CHROME WIRE

REQUIRED

A. Furnish, assemble and set in place, the following stationary storage system shelving, as manufactured by Intermetro Industries Corp*M112. Shelving design and model numbers are based on Metro, Super Erecta Shelf wire shelving, chrome finish, with all standard parts and accessories necessary for a complete installation. Units comprised of the following;

1. Each unit constructed with 74 5/8" high posts.
2. Provide each unit with (4) shelves. Install with shelves at 6" - 28" - 50" - 72" AFF.
3. Provide "S" clips at perpendicular setting shelving to avoid posts located in interior corners.
4. D1A - One (1) unit comprised of 2436NC shelves, 24" x 36".
5. D1B - Three (3) units comprised of 2442NC shelves, 24" x 42".
6. D1C - One (1) unit comprised of 2448NC shelves, 24" x 48".

ITEM NO. D2 -MOP HANGAR
REQUIRED

A. Provide Advance - Tabco model K-242*M112, three mop wall mount mop hanger. S/S construction with Three spring action toothed cam to grip mop handles.

ITEM NO. D3 - MOP SINK
BY OTHER TRADES

ITEM NO. D4 -MOP BUCKET & WRINGER
BY OWNER

ITEM NO. D5 - SHELVING; EPOXY WIRE
REQUIRED

A. Furnish, assemble and set in place, the following stationary storage system shelving, as manufactured by Intermetro Industries Corp*M112. Shelving design and model numbers are based on Metro, Super Erecta Shelf wire shelving, Metroseal III finish with Microban antimicrobial protection, with 12 year limited warranty against rust formation, with all standard parts and accessories necessary for a complete installation. Units comprised of the following;

1. Each unit having 74 5/8" high posts.
2. Each unit comprised of (4) shelves. Install with shelves at 6" - 28" - 50" - 72" AFF
3. Two (2) units comprised of 1842NK3 shelves, 18" x 42".

ITEM NO. D6 - HOSE REEL; WALL MOUNT
REQUIRED

A. Provide stainless steel exposed hose reel, with wall mounting bracket and 35' of hose. Provide standard hose w/adj. hose bumper, with spray attachments. Mount on wall with center line of reel set at 5'-0" above finish floor. Provide with wall mount double pantry control valve, chrome plated rise pipe with (2) chrome plated stand-off wall brackets, 1/2" pressure vacuum breaker. See detail on drawing.

1. Stainless Steel Exposed Hose Reel; Exposed reel rinse w/spray gun; all stainless steel; 35 feet of 5/8" ID, 3 ply, 2 braid hose, working pressure of 150 PSI & withstands 140deg F water temp., 1/2" NPT female; adjustable arm positions allow ceiling, wall, under counter mounting.

   a. Fisher Mfg. model 29599*M112 wall mount hose reel with 32840 spray gun .
   b. Equivalent by T&S.

2. Wall Mount Dbl. Pantry Control Valve; 8" O.C. adjustable wall open body control valve with internal check valves; 3/8" female vertical outlet; lever handles.

   a. Fisher 2200-CV*M112
   b. T&S part number 02832-40*M112 with stops.

3. 1/2" Pressure Vacuum Breaker; high hazard anti-siphon, anti-spill, pressure type vacuum breaker; rough chrome finish. Provide without Tee handle.

   a. Watts 008QT*M112
   b. T&S B-0967*M112
   c. Fisher 14443*M112

4. Chrome plated riser pipe, as required.

   a. T&S chrome Nipple, 3/8 x 24", part no. 000372-40.

5. Chrome plated stand-off wall brackets;

   a. Fisher 2902-12*M112 wall bracket.
   b. T&S B-0109-01*M112 6" wall bracket.

ITEM NO. E1 - WALK IN REFRIGERATOR
REQUIRED

A. Furnish all labor, materials, and equipment for complete installation of sectional walk-in refrigerator unit as shown on drawings and specified herein. Shall include lights, thermometers, pilot lights and accessories for complete first class installation. Install compressors, refrigerant piping and refrigerant as specified.

B. Manufacturers; Specification is based on walk-in boxes as manufactured by Kolpak*M112, N.S.F. approved. Alternate manufacturers include American Panel, Norlake, Master-Bilt. Alternate manufacturers, as listed here-in, must provide equipment of exact same dimensional size, and comparable construction with similar utility requirements to the walk-in box manufacturer on which this specification is based. Use of equivalent manufacturers equipment shall not require changes to the plan, the equipment location or to plumbing / electrical service designated within the contract documents. Listed Equivalent manufacturers are responsible for verifying they comply with these requirements before submitting a bid.

C. Walk-in refrigerator shall comply with the Energy Independence & Security Act of 2007

D. Design Layout and Overall Size; Walk-in unit as shown on plans and as specified. Overall walk-in box size; 11'-7"L. X 12'-7" D. X 9'-0" high from exterior top to bottom of wall panels. Unit shall be installed on a recessed floor/slab furnished by General Contractor, see detail on drawings.

E. Building Constraints; Same as Item C1.

F. Floor; Same as Item C1.

1. As detailed, holes are required in the sub slab same as Item C1.

G. Wall & Ceiling Panels; Same as Item C1.

1. Provide verification, as required by the code authority same as item C1.
2. Sections are fitted together with mating tongue and groove same as Item C1.
3. As detailed, wall panels set in female bottom rail in bottom of floor slab recess same as Item C1.
4. On exposed-to-view exterior of walk-in box panels, provide a 36"H. wainscot of .188 - 6061-T6 mill finish aluminum tread plate, mechanically secured and sealed thereto.

H. Hinged Door shall be 48" x 78". Construct door exterior with 22 ga. stainless steel, interior of same material as interior walls. Door frame with alarm and light management controls. Doors shall be infitting flush type and with insulation same thickness and material as wall sections. Fiberglass Reinforced Plastic door perimeter, jamb and threshold. Heavy duty cast alloy door handle and hinges with powder coat finish. Three (3) positive action self-closing hinges with stainless steel pin and nylon rising cam bearing. Door handle with key lock and inside 1/4 turn safety release handle. Provide thermoplastic gasket with magnetic core at door top and both sides and adjustable sweep gasket at door bottom edge. Provide heater wires around perimeter of door opening and door. Factory-wire heater wires to J-box at door section. Hinge doors as shown on plan.

1. When a concrete wear surface is shown poured inside walk-in box, provide heated threshold secured flush in finished floor at entry door and extended height door frame(s) to allow for concrete wear surface and threshold. Ref detail.
2. Provide hinged door with automatic door closer same as Item C1.
3. Provide flush in floor heated threshold at all hinged and sliding entry doors.
4. Provide hinged doors with spring loaded, positively closing door hinges.
5. Provide (3) hinges per door.
6. Door Handle; Kason 0027C Door Handle with inside release.
7. On the exterior of the door section, adjacent to the door latch side, provide a box for the walk-in digital thermometer & light management system same as Item C1.
8. In addition to digital thermometer, provide door section with exterior, flush mounted, 4-1/2" diameter N.S.F. listed chrome plated dial thermometer.
9. Provide a window in hinged door. Minimum 14" x 14" window. Window shall have triple pane glass with heat-reflective treated glass or gas fill. Window shall be field

replaceable. Window centered at 60" aff.

10. Provide hinged door with an interior mounted thermo-plastic, insulating swing door, 48"W. Construction same as Item C1.
11. On exposed-to-view exterior and interior of hinged walk-in doors, provide 36"H. wainscots same as Item C1.

I. Interior lighting;

1. At junction box / light fixtures on the interior latch side upper corner of the door opening, provide LED light / fixture same as Item C1.
2. Provide, for field installation where shown, One (1) Kason Industries model 1810 LED light fixture, same as Item C1.

J. Structurally design ceiling sections to span area shown, without dip or bulge, in horizontal planes and provide exterior ceiling suspension beams where required.

K. Vertical Trim; Provide same as Item C1.

L. Filler Panels; Provide same as Item C1.

M. Mount Cooper Atkins Notifeye sensor per manufacturers recommendations; ref. Item C1.

ITEM NO. E2 - COMPRESSOR; +35 REFRIGERATOR
REQUIRED

A. Furnish all labor, materials, and equipment for complete installation of walk-in refrigerator refrigeration system. Shall include expansion valve, solenoid valve, temperature control, sight glass, drier, head pressure control, crankcase heater, anti-sweat heater, cables, pilot light, evaporator, pre-charged out door condensing unit, accessories and all other required parts and refrigeration specialties for complete first class installation. Refrigerants shall be in compliance with the Montreal Protocol for reduced CFC content; refrigerator using R-404A. Install compressor, refrigerant piping and refrigerant as specified, hereinafter. See Refrigeration Requirements sub section of this specification section. Equivalent manufacturers must provide equipment of similar dimensional size, and comparable construction and same or higher BTU refrigeration capacities with similar utility requirements to the refrigeration system on which this specification is based. Use of equivalent manufacturers equipment shall not require major changes to the plan, the equipments location or to electrical service designated within the contract documents. Any minor changes required are the responsibility of the provider to coordinate with other trades and all costs associated with changes shall be covered by the provider. Listed Equivalent manufacturers are responsible for verifying they comply with these requirements before submitting a bid.

1. Provide Kolpak Industries pre-fitted remote refrigeration system for remote installation as located on drawings, including all standard parts, refrigeration specialties, factory sized refrigeration lines, pre-charged air cooled condensing unit, with weather-proof cover and low ambient kit/winter controls using head pressure control valves and other items necessary for a complete and properly operating system. Hang evaporators with double nutted nylon bolts.

Provide (5) year compressor warranty.

2. Provide Refrigerator Item No. E1 with Kolpak Industries Model PC99MOP-3P, remote hermetic R404A pre-fitted/pre-refrigerant charged refrigeration system with 1 horsepower condensing unit and AM26-87-1EC-PR-4 evaporator coil for refrigerator to operate at 35degF.
3. Walk-in refrigerator refrigeration system shall comply with the Energy Independence & Security Act of 2007.
4. Weather proof cover shall include a hail screen.

B. Condensing units shall be set on the roof top above the walk-in location, set on curbs provided by other trades.

C. Extend evaporator condensate drains as shown. Extend drain lines with copper tubing having minimum diameter of 5/8" radius per manufacturers recommendations. Run lines as shown with minimum slope of 1/4" per foot.

D. It is the intention of this specification for a complete refrigeration system, including all refrigeration specialties and all other parts, devices and accessories required for a complete and properly functioning system, furnished and installed whether or not each item is specifically mentioned in the specifications.

ITEM NO. E3 - TRANSPORT CABINET; COLD UNIVERSAL PAN
REQUIRED

A. Provide Cambro model CMBPLHD*M112 low profile Combo Cart Plus storage carrier. Overall 27 5/8" x 33 1/2"D x 41 18"H. Durable one-piece molded polyethylene exterior guaranteed to remain rust-free and dent-free; security package with tamper-resistant hardware; wide paddle latches; a perimeter bumper. Store limitless combinations of sheet pans, food pans, pizza boxes, and trays on stainless steel universal rails. Standard capacity (with the (7) pairs of rails included), holds (7) 18" x 26" full size sheet pans, (14) 13" x 18" half size sheet pans, (10) full size 4" deep hotel pans, (14) 2 1/2" deep hotel pans, (14) 12" x 20" trays, or (7) 16" x 16" x 2" pizza boxes. High-performance 6" x 1 1/4" casters all swivel with brakes.

ITEM NO. E4 - RACK; SHEET PAN
RELOCATED

A. Per owner’s directive and selection, relocate tall & half size sheet pan racks from various manufactures with varying models.

ITEM NO. E5 - TRANSPORT CABINET; HOT
RELOCATED

A. Relocate Metro model C5T8-DSB. Overall 30"W x 39.25"D x 65.5"H heavy-duty insulated mobile heated cabinet, 5/6 height, adjustable bottom load slides 3-2/5" OC, top mount solid state digital controls with mobile power (14) 18" x 26" or (28) 12" x 20" x 2-1/2" pan capacity, 304 stainless steel, foamed-in-place polyurethane insulation, maximum temperature 200 degree F, 6" casters.

ITEM NO. E6 - TRANSPORT CABINET; HOT
REQUIRED

A. Provide Cres-Cor Model No. H-339-12-188C*M112, 23-7/8" wide x 31-1/8" deep x 36-11/16" high, on 5" diameter casters. Electro-Mechanical thermostat, thermometer. .063" aluminum inner, outer, top liner and formed door; body reinforced with extruded channels; fully insulated with 1-1/2" fiberglass; field reversible door with spring compression transport latch and perimeter neoprene gasket; lift out 18 ga. 304 stainless steel wire slides on 2-3/4" centers for 18" x 26" and 12" x 20" pans; (3)-300 watt concealed heating elements provide up to 200deg heating capacity; lighted on/off switch; cord and plug set; two bale handles on each side.

ITEM NO. E7 - TRANSPORT CABINET; HOT
RELOCATED

A. Relocate from the current high school central kitchen, Cres-Cor model H339-128C insulated aluminum hot cabinet for 12 x 20 pans; overall 18-7/8" wide x 25-1/2" deep x 36-11/16" high, on 5" diameter casters.

ITEM NO. F1 - HAND; SINK
REQUIRED

A. Provide Advance Tabco Model No. 7-PS-71*M112, overall 17-1/4"L. x 15-1/4"D. X 13"H. 304 stainless steel, with deep drawn 10"front-to-back x 14"W x 5" bowl, recessed no drip edge. Includes; heavy gauge galvanized mounting bracket, 1-1/2" stainless steel basket drain. Provide with the following;

1. K-121 Faucet, splash-mount, gooseneck
2. 7-PS 36 -Side mounting wall brackets for added strength.
3. 7-PS-17 -Side Splashes, for hand sinks, on two sides.
4. Provide .5 GPM Low flow faucet aerator(s).

B. Provide with T&S model B-0504-02 Double Pedal Valve, wall mounted, inlets on 2 1/2" centers, 1" from wall to center of inlets, wall to pedal tips approx. 13 3/4", angle loose key stops, top mounted volume control straight loose key stop. Provide wall blocking support as necessary.

C. Soap & towel dispenser & Waste receptacle (By Owner)

ITEM NO. F2 - REFRIGERATOR; (2) SECT GLASS DOOR REACH-IN
REQUIRED

A. Provide Traulsen model G21010, (2) section reach-in refrigerator with glass doors; overall 52 1/8"W. x 32"D x 83 1/4"H. 20 ga. S/S cabinet exterior front, louver assembly and doors; anodized aluminum cabinet sides (including returns), interior liners; heavy gauge aluminized steel exterior cabinet top and bottom; four (4) - 6" high casters; gasket protecting metal door pan; removable plug cylinder locks; full length hinged glass doors with locks; life guaranteed cam-lift, gravity action, self-closing metal, glide hinges w/ 120 degree stay open; automatic light switch; recessed horizontal door handles; easily removable vinyl magnetic door gaskets; anti condensate

heaters; average of 2" thick high density, non-CFC, foamed polyurethane in doors and cabinet; top mounted, self-contained, balanced R-134a refrigeration system; easy to clean front facing condenser, thermostatic expansion valve, air-cooled hermetic compressor; large, high humidity evaporator coil located outside the food zone; non-electric condensate evaporator; water resistant microprocessor control with a 3-Digit LED Display, and Fahrenheit or Celsius temp.; Std. with three (3) epoxy coated wire shelves per section; full-width 225 lbs capacity shelves. A 9' cord & plug; 34 to 38 degree F. standard operation; (5) year compressor warranty.

1. Doors hinged left and right as shown.
2. Two (2) additional std. epoxy coated wire shelves (total of (8) shelves req'd)

ITEM NO. F3 - OVEN; GAS ROLL-IN CONVECTION
REQUIRED

A. Provide Baxter model OV500G1*M112, gas, rotating single rack convection oven; overall 55"W. x 83.5"D (incls hood) x 99.5"H. Stainless steel construction; manufactured in the United States; max. 55.0"W x 51.0"D foot prints x 105.0"H; integral hood with min. 31.0" overhang; single point vent connection for Type II installations; oven has independent electrically interlocked air safety switches for the draft inducer and hood; control panel has programmable settings with auto on/off feature and 4-step bake/roast setting ; oven has in-shot burner system with a heat exchanger consisting of 18 independent high-temperature, stainless steel tubes; in-shot burners have no moving parts; self-contained spherical cast steam system which converts 1.0 gallon of water into steam within 20 seconds at >400degF.; field reversible oven door with three panes of glass; adjustable flush floor doesn't require a ramp; diagnostic center with status indicator lights; energy saving idle mode; built-in levelers. Provide with the following;

1. UL Listed, Type I hood with grease filters. Listed to UL 710 standard and meets requirements of NFPA-96. Has a single point exhaust.
2. Manual back-up control.
3. Left rear drain.

ITEM NO. F4 - OVEN RACK; SIDE LOAD UNIV. PAN
REQUIRED

A. Provide BSRSBFS-13A*M112 fully assembled and welded roll-in S/S side load oven rack for use in single or double rack ovens; overall 28. 4"W. x 20.3"D. x 69.8"H. 16ga. S/S; 4" swivel type casters w/ life-time lubricated wheel bearings rated for 515degF., 250 lbs. each; each rack holds (13) - 18" x 26" or (26) - 12" x 20" x 4" pans at 4.7" O.C. spacing; Baxter Style Lift. Available from Brite Light Welding, 253-875-6291, email - britelight@hotmail.com

ITEM NO. F5 - OVEN RACK; 20 SHEET PAN END LOAD
REQUIRED

A. Provide Baxter model BSRSB-20A roll-in S/S single end load oven racks for use in a single rack oven; overall 20.38"W. x 26"D. x 69.8"H. Each rack holding (20) - 18" x 26" pans at 3" O.C. spacing; Baxter Style Lift. 16 ga. S/S; 4" swivel casters with life-time lubricated wheel bearings, rated for 515degF, assembled and welded.

ITEM NO. F6 - PROOF BOX; ROLL-IN
REQUIRED

A. Provide Baxter model PW1E- 34"D- FL*M112 Overall 36.8"D x 35.5"W x 99.5"H. roll-in, holds (1) single end or side load rack, stainless steel exterior & interior, eye-level digital control panel, digital controls in door , electric heat, field reversible door, Patented air flow system; Easy access heat and humidity system; Internally mounted; No flushing required; Field reversible door; Set heat/humidity system; Four independent timers; Stainless steel interior and exterior; Modular panel construction with cam lock attachment.

1. Ship fully assembled.
2. Provide with stainless steel floor, no ramp required.

ITEM NO. F7 - OVEN; GAS DOUBLE STACK CONVECTION
REQUIRED

A. Provide G.S. Blodgett Model DFG-100-Double*M112, double stack gas oven; overall 38-1/8"W. x 36-7/8"D. x 76-5/8" to top of diverter. Each compartment to have; stainless steel front, sides, top and legs; black enamel back; 14 ga. double sided porcelainized baking compartment liner; interior lights; slide out control module; simultaneously operating doors; (5) chrome plated wire racks per section; cool down or auto off interlock at door opening blower options; electronic spark ignition control system; front mounted manual gas service cut-off switch; (2) speed motor fan; 1/3HP blower motor; pressure regulator; mineral fiber insulation at top-sides-back-bottom. Each oven compartment 55,000 B.T.U. (2) year parts and labor warranty; (5) year door warranty. Provide the following options:

1. Solid state manual control package.
2. Doors with dual pane thermal windows.
3. Draft diverter for under hood installation.
4. Common Connection point gas manifold.
5. Low profile 4-1/4" casters, front Two locking.

B. Provide T & S series HG-4D-SK*M112 Safe-T-Link commercial appliance connector hose kit (equivalent = Dormont Dbl. Supr-Swivel Deluxe Install Kit). Kit includes: (2) Smart-Link swivel link connector fittings; 3/4" x 60" - 321 stainless steel, hydraulically formed flexible pipe with male nipple, S/S braided outer webbing, industrial cold welded fittings; Hansen manufacturing quick disconnect; 60" restraining cable with anchoring hardware; gas ball valve; (1) street EL. 10 year normal use warranty on structural integrity of hose against leaks, 5 year connector warranty. Provide the following options;

1. Provide with 2nd street EL fitting.

C. Secured to the floor beneath the rear casters provide Dormont model Safety-Set mobile cooking equipment locators; overall 7-7/16"L. x 3-5/8"W. Open floor design allows caster to rest level on the floor to ensure even cooking; composed of a flame retardant PC/ABS injection molded blend; able to withstand 1000 lbs of crush force; compatible with 4", 5" and 6" casters; installation with adhesive foam tape or thumb screw hardware pack; set in sealant and secure to

floor per manufacturers recommendations with either manufacturer provided installation methods.

ITEM NO. F8 - EXHAUST VENTILATION HOOD
BY OTHERS TRADES

ITEM NO. G1 - KETTLE; ELECT 20 QT. ON STAND
REQUIRED

A. Provide Groen model TDB-20*M112. Overall 25.63"W x 20.75"D x 23.13"H. 304 stainless steel, self-contained, electrically heated steam jacketed kettle. One piece welded kettle body, 2/3 jacket, 304 stainless steel liner, hand tilt, faucet bracket, support console on right, stainless steel construction. S/S self-contained steam jacketed kettle with internal electric heated steam source; all S/S; 304 stainless steel, one-piece welded construction kettle; gasketed controls enclosure: heavy reinforced rim with welded-in butterfly shaped pouring lip; Right or left hand tilt handle; faucet bracket mounted on rear of electrical control box; ASME code, and U.L. Listing; Unit shall be ASME shop inspected, stamped and registered; max. working pressure of 50 PSI; NSF construction & listed; kettle temperatures of 150degF to approx. 295degF; 20 qt. model will have 6.3 KW input; factory charged with water and rust inhibitors; thermostat, built in contactor, pressure gauge, front mounted water sight glass and heating indicator lamp; safety tilt heat cut-off, pressure relief valve, high limit pressure switch and low water cut-off. 24V control system; field reversible tilt handle; Provide the following options:

1. 480V / 3PH
2. One piece lift off cover.
3. Model No. TS/9S-2, 124700 stainless steel support stand, with mobile drain cart, overall 28"W. x 30"D. x 17-1/2"H. All stainless steel 1-1/2" square tube open leg stand with adj. bullet feet. Separate drain cart with 6" deep drain basin with 1-1/2" drain, stowed under kettle support stand, pulls out for emptying kettle or to support various pans / pails; removable front hinged splash shield / work surface; rear casters and front glides; drain basin empties into to fixed lower drain pan with 1-1/2" drain.
4. Provide with standard faucet mounting bracket on back of controls pedestal.
5. Double pantry faucet.

B. Provide with Two (2) Dormont model W50B36*M112 Safety System Hi-PSI® Water Connector Hose; 1/2" dia.; 36" long; covered with stainless steel braid; NPT male thread on one end; NPT female thread on one end; limited lifetime warranty.

ITEM NO. G2 -BRAISING PAN; GAS 40 GAL. WITH DRAW OFF'
REQUIRED

A. Provide Groen model BPM-40G-NAT-TDO*M112, Eclipse Ergonomic Braising Pan; overall 48W x 39.75"D x 43.3"H. Natural gas powered; 40-gallon capacity; 10" deep pan with 3/8" S/S clad bottom plate having bottom heat transfer fins; 2" tangent drawoff; 38" pan rim height; The braising pan shall have a smooth-action, quick-tilting body with manual crank tilt mechanism; round tubular open leg base; 304 stainless steel construction; bullet feet; electronic spark ignition; fully adjustable counterbalanced vented cover; thermostatic control.

Provide with the following options;

1. Pouring Lip Strainer, for tilting braising pans (079995)
2. Provide staff left side mounting bracket for faucet.
3. 2" tangent draw-off.
4. Tangent draw-off strainer.

B. Mounted to the left side fill faucet bracket, provide a modified Fisher model 2160 Utility Spray hose with single hole deck mount double valve control, top mounted swivel vacuum breaker, 60" long flexible stainless steel hose, utility spray valve, wall hook. Provide with the following modifications;

1. Provide with 2828 add-on faucet with 12" swing spout and swivel outlet.
2. Riser pipe height, as necessary for fill spout to swing over pan rim.

C. Provide T & S series HG-4D-36S*M112 Safe-T-Link commercial stationary appliance connector hose kit (equivalent = Dormont Single Supr-Swivel Deluxe Install Kit). Kit includes: 3/4" x 36" - 321 stainless steel, hydraulically formed flexible pipe with male nipple one end, S/S braided outer webbing, industrial cold welded fittings; Hansen manufacturing quick disconnect other end with brass swivel elbow fitting. 10 year normal use warranty on structural integrity of hose against leaks, 5 year connector warranty.

1. Provide with 2nd street EL fitting.

D. Provide with a draw-off drain bucket with drain and hose as detailed. Provide Vollrath model 78740 stainless steel bain marie pan, 6-1/2"Dia. X 7-5/8"H. Punch opposing sides of pan near upper rim and provide a hinging S/S wire hanging handle. Loop of wire handle to hang over draw-off with pan suspended below. Pan to be easily removable. Provide in the bottom of the pan, a Component Hardware E32-4900 stainless steel flat strainer drain with 1-1/2" NPS outlet. Provide on the outlet, Component Hardware model E22-4121, 1-1/2" x 4" nickel plated brass tailpiece. Provide on the tail piece, 1-1/2"I.D. plastic hose secured with a stainless steel radiator clamp, extending to 6" above the floor with the pan in the horizontal position.

E. Provide with Two (2) Dormont model W50B36*M112 Safety System Hi-PSI® Water Connector Hose; 1/2" dia.;368" long; covered with stainless steel braid;. 2 year warranty.

ITEM NO. G3 -HOOD TYPE 1 W/ FIRE SUPPRESSION
BY OTHER TRADES

ITEM NO. G4 -HOOD TYPE 1 W/ FIRE SUPPRESSION
BY OTHER TRADES

ITEM NO. G5 - KETTLE; ELECT. 60 GAL TILT
REQUIRED

A. Provide Groen model DEE/4-60*M112, 60 gallon electric self contained, tilting, stainless steel steam jacketed kettle; overall 47"W. x 36 3/8"D. x 44 1/8"H. to kettle lip. All stainless steel

construction with reinforced bar rim; butterfly shaped pouring lip and smooth action mechanical tilt. Kettle body shall be mounted in heavy duty stainless steel combination kettle support tilt trunnion, which is supported by stainless steel enclosed base. Controls shall include a thermostat, built-in contactor, safety tilt cut-off, safety valve, pressure gauge, water sight glass, heat indicator light and low water cutoff. NSF listed, ASME code constructed for 50 PSI and UL listed. Provide with the following options;

1. 2" tangent draw-off valve.
2. Draw off valve 1/4" perforated disk strainer.
3. Hinged cover.
4. Gallon etch marks, 5 gallon increments.
5. 480V. - 3PH, 24KW, 29A.
6. Faucet, double pantry with 48" spray hose.
7. Kettle shall comply with CSD-1 requirements.

B. Provide with Two (2) Dormont model W50B2Q36*M112 Safety System Hi-PSI® Water Connector Hose; 1/2" dia.; 36" long; covered with stainless steel braid; Brass two way Quick Disconnect coupling, 2 year warranty.

ITEM NO. G6 - OVEN-STEAMER; GAS BOILERLESS COMBINATION
REQUIRED

A. Provide Convotherm model C4eT 10.20 GS VT*M112, overall approx. 53"W x 44.9"D x 50.4"H. Natural gas; boilerless; (11) 18" x 26" full size sheet pan or (22) 12" x 20" x 1" hotel pan capacity; 9" easyTouch control panel; 20 stages each & 399 cooking recipes storage; (4) cooking modes: hot air, steam, combi-steam & retherm, multi-point core temperature probe; five-speed auto reversing fan; right-hand hinged door; anti-microbial hygienic door handle; pull-out spray hose; stainless steel construction. Provide units with the following options;

1. Provide Extended Warranty EWI CON
2. Disappearing door
3. Open stand with storage shelf and cover panel (3251501)
4. Convoclean auto clean system
5. Convoclean Solution
6. ConvoCare solution
7. Provide CSC stainless steel storage container for cleaning solutions.
8. Provide additional standard wire shelves to accommodate (10) - 18 x 26 sheet pans..
9. Provide (20) - 12 x 20 frying basket model CWB20

B. Provide One (1) Everpure Claris water treatment systems, with (1) Pre-Filter, (1) Claris X-Large Steam System, (1) Claris Flow Meter, (1) Water Test Kit. X-Large Steam cartridge may be mounted horizontal or vertical. Clear housing pre-filter, with tightly spun 10 micron sediment cartridge, accepts most drop-in cartridges; corrosion resistant single cartridge filter head with zero bypass; water test kit to determine the scale hardness of the water; X-large filter cartridge with 5-stage filtration - NSF certified under NSF/ANSI standard 42; Flow sensor & display monitors water usage / cartridge replacement time.

1. Provide to the manufacturer, before equipment installation, a water quality analysis. Notify Architect / Food Service Consultant of water quality problems exceeding the filtration capabilities of the treatment system and make recommendations of systems to meet the water quality standards.

C. Provide Dormont Safety System Hi-PSI® Water Connector Hoses. Hoses covered with stainless steel braid; NPT male thread on one end; NPT female thread on one end; limited lifetime warranty.

1. Two (2) model W75B48*M112, 3/4" dia. x 48"L.
2. One (1) model W75B36*M112 , 3/4"dia. x 36"L.

D. Provide T & S series HG-4D-48S*M112 Safe-T-Link commercial stationary appliance connector hose kit (equivalent = Dormont Single Supr-Swivel Deluxe Install Kit). Kit includes: Kit includes: 3/4" x 36"L. - 321 stainless steel, hydraulically formed flexible pipe with S/S braided outer webbing, industrial cold welded fittings; (2) brass swivel elbow fittings, (1) Hansen manufacturing quick disconnect and (2) 90deg elbows. 10 year normal use warranty on structural integrity of hose against leaks, 5 year connector warranty.

ITEM NO. H1 - SHELVING; CLEAN POT & PAN
REQUIRED

A. Provide Intermetro Industries Corp (Metro) MetroMax Q Polymer and Steel Storage System shelving. General construction; finger operated quick release corner shelf position locks removable non-rusting ventilated polymer shelf mats in 12" and 18" modules which easily fit dish machines and lay over truss wire shelf frames; shelf mats with Microban antimicrobial protection; 800 lbs per shelf capacity on 48"L. shelf. Each unit complete with all standard parts and accessories necessary for a complete installation. Units comprised of the following;

1. Four (4) model MQ2448G open grid mat shelves, 24"W. x 48"L. with frame and wedge lock connectors. Install with shelves at 6" - 26" - 46" - 66" AFF.
2. Four (4) Metromax Q epoxy coated steel model MQ74UPE posts, 74-3/4"H.
3. One (1) model MTR2448XEA tray drying rack system to support trays vertically at 3" on center on the top shelf.
4. Steel stem/horn casters with resilient tread; Two (2) 5MX stem swivel casters; Two (2) 5MBX stem swivel casters with brakes.

ITEM NO. J1 - SLICER; MANUAL
RELOCATED

A. Relocate from the current high school central kitchen, a manual Hobart slicer .

ITEM NO. J2 - STAND; MOBILE SLICER
RELOCATED

A. Relocate from the current high school central kitchen the stand on which Item J1 currently is setting.

ITEM NO. J3 - WASTE BARREL; UNDER COUNTER
REQUIRED

A. Provide Rubbermaid model FG354060*M112; 23 gallon Slim Jim® Waste Container, w/handles, overall 20"L x 11"W x 30"H. General purpose waste, open type without lid, high-impact plastic construction, gray.

ITEM NO. J4 - TABLE; WORK W/ DRAWERS / SHELVES
REQUIRED

A. Provide overall 120"L. x 30"D. x 36"H. to work top. Construct top in accordance with standard specifications for Metal Tops.

1. Abacking tables J4 and J7 have continuous/contiguous tops; formed from a common stainless steel sheet or continuously welded / polished without butt joint / curb / backsplash.
2. Provide 3/4"H. inverted "V" edge at exposed table edges. Turn down from "V" edge 1-1/2", and 1/2" toe-in on 30deg angle.

B. Provide centered at 29" from staff right end, a standard Metal Top integral sink . Sink, 20"W. x 20"D. x 12"H.

1. Provide sink with 1/2" Single Hole Deck Mount Faucet; 1/2" double valve faucet with 10" or 12" swing spout, chrome finish;

a) Fisher Mfg. Co. 3112*M112 or 3113*M112.
b) T&S Brass model B-0200-LN 061X*M112 swivel nozzle or B-0201*M112.

2. Provide the sink bowl with Fisher Mfg. Co., 22209*M112, 2" rough chrome rotary ball action lever drain having stainless steel bar and flat stainless steel strainer plate. Provide with 6" tail piece.

C. Provide Electrical Receptacle boxes where shown, per standards. Electrical device(s), connection(s) and cover plate(s) by Other Trades.

1. Provide (2) under top Electrical Receptacle boxes, (1) at each end, where shown.

D. Provide, a tier of (3) Drawers at the staff right end, as shown, per standards, in Enclosed Cabinet Base.

E. Provide a Vertical Cutting Board Rack on the staff left side of the (3) tier drawers, as detailed and per standards. Provide with (2) Carlisle model Sparta Spectrum Evershield high density polyethylene cutting boards with permanent NSF logo imprint. Hygienic surface texture, rounded corners, smooth on both sides. Provide 24" x 18" x 1/2" thick: color tan.

F. Provide Open Frame Base, per standards.

1. No front crossrails at under counter serviceable or mobile / movable items.
2. Provide with standard 52" Stationary Undershelf, between the drawers and sink, as shown.

G. Provide with Flanged Feet; Provide flanged feet on front legs, sealed & securely anchored to the floor.

ITEM NO. J5 - RACK; H.D. TALL UNIVERSAL PAN
REQUIRED

A. Provide New Age model 4339*M112 pan rack; overall 21.5"W x 73"H. x 26"L. (20) pan capacity at 3" spacing, for 12 x 20 and 18 x 26 pans; all welded aluminum construction. End loading with 1-1/4" x 3-1/4" x .100 extruded aluminum universal angle tray slides welded to smooth "D" shaped aluminum uprights/frame. 6" x 2" casters, full swivel with sealed ball bearing.

ITEM NO. J6 - CABINET; ELEV DOOR DBL SIDED
REQUIRED

A. Provide Jamestown Metal Products model PT203-36 pass thru painted steel wall cabinet with double hinged doors with turn knob with integral latching mechanism on both sides. Overall 36"L. x 18"D. x 30"H. Fabricated of 18Ga. sheet steel as integral units, flush face joints, angle reinforced or welded corners, 1 1/4"W. exposed face rails and stiles with 3/4" x 1/2" rabbet for doors, finished ends. 5'8" thick insulated double pan doors with 18Ga. outer and 20Ga. inner heads, 14Ga. reinforced hinge attachment points, rubber door bumpers. Shelves adjustable on 1/2" centers, flanged down 1" all edges with front and back having 45 degree angle turn up back to bottom of shelf, supported on cadmium plated brackets inserted in slots in vertical supports. Satin chromium plated hardware, 5 knuckle institutional stainless steel hinges with lubricating spacers. Steel shall be treated with a heated alkaline base acid solution, rinsed with water and a coat of epoxy link applied, immediately dried in heated ovens, then gradually cooled prior to application of finish. Electrostatically apply epoxy powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory finish. Color Pepper Dust #415.

ITEM NO. J7 - TABLE; VEGETABLE W/ DBL WORK AND SCRAP SINK
REQUIRED

A. Provide overall 120"L. x 30"D. x 36"H. to top of "V" edge. Construct top in accordance with standard specifications for Metal Tops.

1. Abacking tables J4 and J7 have continuous/contiguous tops; formed from a common stainless steel sheet or continuously welded / polished without butt joint / curb / backsplash.
2. Provide 3/4"H. inverted "V" edge at exposed table edges. Turn down from "V" edge 1-1/2", and 1/2" toe-in on 30deg angle.

B. Work Sink; centered at 39" from the staff right end, as shown, provide a standard Metal Top integral sink, 20"W. x 20"D. x 12"H. Provide with the following;

1. Deck Mount Work Sink Faucet ; provide a 1/2" Single Hole Deck Mount Faucet; 1/2" double valve faucet with 10" or 12" swing spout, chrome finish; Provide with maximum 2.2 GPM faucet aerator(s).

   a. Fisher Mfg. Co. 3112*M112 or 3113*M112.
   b. T&S Brass model B-0200-LN 061X*M112 swivel nozzle or B-0201*M112

2. Provide sink bowl with Fisher Mfg. Co., 22209*M112, 2" rough chrome rotary ball action lever drain having stainless steel bar and flat stainless steel strainer plate. Provide with 6" tail piece.

C. Provide adjacent right to the work sink, as shown, a Waste / Scraping Sink with basket. Standard Metal Top integral sink, 10"W. x 20"D. x 8"H. Provide in the sink, a removable S/S waste collection pan, sized 1/2" less in width & length and 1" shorter in height than the sink bowl. Waste collection pan constructed of 18 ga. 304 S/S with 1/4" diameter holes in bottom and sides at 3/4" O.C. max. Provide with Two (2) Component Hardware model P68-1010 heavy duty stainless steel straight back drop handles; One (1) each centered on the interior of each side. Provide Four (4) - 1/4"L. x 1/8" dia. studs welded to the bottom of the pan, One at each corner to support the pan 1/4" off the bottom of the sink. Provide with the following;

1. Pre-Rinse Spray; Deck Mount Spring Type Pre-rinse Spray centered behind sink with spray head centered over sink. Single hole deck mount double valve control, flexible stainless steel hose wrapped with stainless steel support spring;

   a. Fisher Model 2110*M112 with Ultra Spray Valve using 1.15 GPM @ 60 PSI
   b. T & S model B-0113*M112 with B-0107-J, fan style 1.1 gpm spray head & valve.

2. Provide sink bowl with Fisher Mfg. Co., 22209*M112, 2" rough chrome rotary ball action lever drain having stainless steel bar and flat stainless steel strainer plate. Provide with 6" tail piece.

D. Provide Can Opener at the staff right end near the staff side, as shown. Mount on a 3/4" high platform, flush to top of the table edge at exposed sides; sloping down 45deg and integral to the top. Atop the platform, provide an Edlund model no. S-11*M112 manual stainless steel can opener, NSF certified, with cast S/S base, reversible S/S blade, dishwasher safe, opens cans to 14"H. Set base of can opener in sealant at installation and wipe away excess.

E. Shared Spanning Shelf; Provide, as detailed, centered between the abacking tables and equally overhanging each, a 120"L. X 18"D. fixed elevated shelf;

1. 18" above table top.
2. Flat top with 1" turn down and 1/2" toe-in at 30deg. at all exposed sides.
3. Provide with (2) - 1" x 4" x 1" x 14 ga. continuous length S/S reinforcing hat channels below

the shelf to allow unsupported span of shelf between end supports.

4. Support the shared elevated shelf ends with 18"W. x 1-1/2" thick box supports. Provide double pan stainless steel supports with 16 ga. exterior pans, 20 ga. interior pans. Interior pans constructed with 90deg. x 1-1/2" returns at vertical sides. Exterior pans similar, inset to edges of interior pan edges. Top edge of interior pan turned outward 90deg for 1" and stud bolted to bottom of elevated shelf. Continuously weld bottom of support pans to Metal Top with exterior pan face flush to face edge of table.
5. Provide close tolerance hole in shelf for pre-rinse spray riser pipe, where shown.

F. Provide Electrical Receptacle boxes where shown, per standards. Electrical device(s), connection(s) and cover plate(s) by Other Trades.

1. Provide Two (2) under top Electrical Receptacle boxes, (1) at each end, where shown.
2. Provide (1) under elevated shelf Electrical Receptacle box, where shown, per standards for Electrical Receptacles. Vertically mounted box below the shelf with concealed routing of feed wires thru elevated shelf supports to the electrical box.

G. Provide, a tier of (3) Drawers, at the staff left end, where shown, per standards, in Enclosed Cabinet Base.

H. Provide Vertical Cutting Board Rack, on the staff right side of the drawer enclosure, as detailed and per standards. Provide with (2) Carlisle model Sparta Spectrum Evershield high density polyethylene with permanent NSF logo imprint. Hygienic surface texture, rounded corners, smooth on both sides. Provide 24" x 18" x 1/2" thick: color green.

I. Provide Open Frame Base, per standards.

1. No front crossrails at under counter serviceable or mobile / movable items.
2. Provide with standard 42" Stationary Undershelf between sinks and drawers, as shown.

J. Provide with Flanged Feet; Provide flanged feet on front legs, sealed & securely anchored to the floor.

ITEM NO. J8 - SLICER; VEGETABLE
REQUIRED

A. Provide Piper model Anliker GSM4 food processor; overall 10.24"W. x 17.72"D. x 20.87"H. Kidney shaped material pusher is made from mold cast food grade aluminum ; powerful 1/2 HP gear-driven motor; sealed planetary gear transmission with permanent grease lubrication; polished food grade cast aluminum construction & sealed upper housing; double safety interlock - hopper latch serves as the on/off switch and interlocks to hopper head - will not operate with hopper head open or unlatched; ergonomic 45deg. food hopper incline; removable hopper head and food pusher (no tools required); discs are antimicrobial durable composite fiberglass & dishwasher safe; stainless steel knives are hardened, ground, leathered and hand-polished; 42 discs are available. 1/2 HP, 115V-60HZ-1 Phase, 3 amps, automatic reset, thermal overload protection. Provide with the following;

1. G3-5 - 1/8" slicing blade.
2. G10-5 - 3/8" slicing blade.
3. W8-5 - Cubing Disc, 5/16" cube cut size.
4. SU5-5 - Slicing Disc, 3/16" wavy cut size.
5. TO-5 - Tomato Slicing Disc, 3/16" cut size
6. Two (2) - SCV 7/3 vertical disc storage racks holding (3) discs each.

ITEM NO. J9 - STAND; MOBILE EQUIPMENT
REQUIRED

A. Provide Pacific Stainless Product model MES243024CO*M112. Equipment Stand, 24"L x 30"W x 24"H, 16/304 stainless steel top, 14 gauge galvanized "HAT" channels, stainless tube stretchers welded to (4) each 1-5/8" stainless tube legs on casters,

ITEM NO. J10 - PIPE CHASE
REQUIRED

A. Provide, as detailed, 9"W. x 5"D. plumbing chase extending from floor to 3" above ceiling. Field verify and coordinate chase size with roughed-in pipe and ceiling height. Weld to counter top and brace to structure above ceiling. Fabricate in a "C" configuration of 18 GA. S/S with full width removable cover facing away from the table. Secure cover to 1" return edges of body with S/S screws at 12" O.C. Provide 1" x16ga. S/S unistrut pipe carriers tack welded to interior back at top and 36" AFF. At floor, provide with 1-1/2" 18 ga. S/S angles on all interior sides, tack welded in. Set angles in a bed of sealant at installation and expansion anchor to floor. Seal to all adjacent surfaces. Provide 1" S/S trim ring at ceiling. Punch and seal holes in back of chase at locations directed by P.C. for exit of piping.

ITEM NO. J11- 1/2 RACK; SHEET PAN
REQUIRED

A. Provide Channel Manufacturing model AXD1825*M112 1/2H. heavy duty pan rack; overall 22"W. x 26"D. x 36"H. End load rack; (9) pan capacity at 3" spacing; holds 18" X 26" & 18" X 13" Bun Pans & 17" X 25" Fryer Screens; fully Heli arc welded, heavy duty, high tensile extruded aluminum type 6063-T5 alloy; Lifetime Warranty for traditional food-service applications; 1" x 1-1/2" x .10" extruded aluminum tray slide angles heli-arc welded to frame; vertical and horizontal frame sections are extruded extra thick walls 1-1/4" tubular aluminum with radius top corner; Extra heavy duty platform type casters, 5" x 2" w/ Zerk grease fittings, full swivel design; casters bolted to frame to facilitate replacements.

ITEM NO. K1 - SHELVING; CLEAN POT AND PAN
REQUIRED

A. Provide Intermetro Industries Corp (Metro) MetroMax Q Polymer and Steel Storage System shelving. General construction; finger operated quick release corner shelf position locks removable non-rusting ventilated polymer shelf mats in 12" and 18" modules which easily fit dish machines and lay over truss wire shelf frames; shelf mats with Microban antimicrobial protection; 800 lbs per shelf capacity on 48"L. shelf. Each unit complete with all standard parts and

accessories necessary for a complete installation. Units comprised of the following;

1. Four (4) model MQ2460G open grid mat shelves, 24"W. x 60"L. with frame and wedge lock connectors. Install with shelves at 6" - 26" - 46" - 66" AFF.
2. Four (4) Metromax Q epoxy coated steel model MQ74UPE posts, 74-3/4"H.
3. One (1) model MTR2460XEA tray drying rack system to support trays vertically at 3" on center on the top shelf.
4. Steel stem/horn casters with resilient tread; Two (2) 5MX stem swivel casters; Two (2) 5MBX stem swivel casters with brakes.

ITEM NO. K2 - TABLE; WORK W/ DRAWERS / SHELVES
REQUIRED

A. Provide overall 120"L. x 30"D. x 36"H. to work top. Construct top in accordance with standard specifications for Metal Tops.

1. Abacking tables K2 and K10 have continuous/contiguous tops; formed from a common stainless steel sheet or continuously welded / polished without butt joint / curb / backsplash.
2. Provide flat top with exposed edges having standard 1-1/2"x 90deg straight turn down and 1/2" toe-in on 30deg angle.

B. Provide Electrical Receptacle boxes where shown, per standards. Electrical device(s), connection(s) and cover plate(s) by Other Trades.

1. Provide (2) under top Electrical Receptacle boxes, (1) at teach end where shown.

C. Provide, a tier of (3) Drawers at the staff left end, as shown, per standards, in Enclosed Cabinet Base.

D. Provide Vertical Cutting Board Rack, on the staff right side of the drawer enclosure, as detailed and per standards. Provide with (2) Carlisle model Sparta Spectrum Evershield high density polyethylene with permanent NSF logo imprint. Hygienic surface texture, rounded corners, smooth on both sides. Provide 24" x 18" x 1/2" thick: color yellow.

E. Provide Open Frame Base, per standards.

1. Provide with standard 7'-7" Stationary Undershelf to the staff right of the drawers, as shown.

F. Provide with Flanged Feet; Provide flanged feet on front legs, sealed & securely anchored to the floor.

ITEM NO. K3 - MIXER; 20 QT
REQUIRED

A. Relocate from the current high school central kitchen a Hobart A200, bench type 20 qt. mixer; overall 14-3/4"W. x 20-3/4"D. x 30-3/8"H.

ITEM NO. K4 - STAND; MIXER
RELOCATED

A. Relocate from the current high school central kitchen, with Item K3, a mixer stand.

ITEM NO. K5 - STAND; WATER DISPENSER
REQUIRED

A. Provide Pacific Stainless model MES243030FS*M112 Equipment Stand; overall 24"W. x 30"L. x 30"H. 16/304 stainless steel top reinforced with 14ga galvanized "HAT" channels; stainless steel under shelf welded to (4) each 1-5/8" S/S tube legs with S/S adjustable feet; fully assembled NSF.

ITEM NO. K6 - DISPENSER; 25 GAL HOT WATER
REQUIRED

A. Provide Fetco model HWB-25*M112, 25 gallon hot water dispenser; overall 28"W. X 23-1/2"D. X 33"H. All stainless steel construction; full insulated side and top; controlled refill provides hot water continuously with no recovery time; protected control system; full automatic; top mounted control components; serviceable from the front & top; guard protected water gauge; guard protected faucet;11 3/4" faucet clearance. Provide with the following;

1. Model H25011, 120/208V, 3PH, 13.8KW, 38.2A electrical.

B. Secured to the adjacent shelf support end, in an accessible location, provide a 3M BREW130-MS Aqua-Pure® Valve-In-Head Water Filter System, single vessel, .5 micron rating, 1.67 gpm (6.3lpm) flow rate, 14,000 gal (52995 lit.) cap., reduces sediment, chlorine taste & odor, scale, for coffee/hot tea brewers.

C. Provide with Dormont model W37B36*M112 Safety System Hi-PSI® Water Connector Hose; 3/8" dia.; 36" long; covered with stainless steel braid; NPT male thread on one end; NPT female thread on one end; limited lifetime warranty.

ITEM NO. K7 - OVEN; MICROWAVE
REQUIRED

A. Provide ACP, INC Model RFS12TS *M112, 1200 watt cooking power medium duty commercial microwave; overall 21-3/4"W. x 20-1/4"D. x 14-1/4"H. 14-1/4"W. x 16-3/8"D. x 9"H. usable interior dimensions; 1.2 cubic foot capacity accommodates a 14" platter; 10 pad touch control panel with 100 total programmable settings; four stage cooking option for one-touch control; variable entry timing; five power levels; Braille touch pads; removable air filter with clean filter reminder; S/S interior and exterior; 60 min. countdown timer; stackable; interior light; pull handle door opening; top feed rotating microwave antenna; door interlock safety switches; full (3) year warranty; cord and plug set. Meets all safety requirements of the Performance Standard for Microwave Ovens of the U.S. Govt. Dept. of Health.

ITEM NO. K8 - WASTE BARREL; UNDER COUNTER
REQUIRED

A. Provide Rubbermaid model FG354060*M112, 23 gallon Slim Jim® Waste Container, overall 22"L x 11"W x 30"H. Venting channels; molded-in handles, general purpose waste container; open type without lid; high-impact plastic construction; gray.

ITEM NO. K9 - ELECTRIC CAN OPENER
REQUIRED

A. Edlund model 270*M112 electric can opener; overall approx. 6 3/4"W x 11 1/2"D x 10"H. For heavy volume; 2-speed motor; knife and gear assemblies that are removable for cleaning; recommended for up to 200 cans per day; NSF certified; 115v, 1.2A

ITEM NO. K10 - TABLE; COOKS W/ DRWS - SHELF
REQUIRED

A. Provide overall 120"L. x 30"D. x 36"H. to top. Construct top in accordance with standard specifications for Metal Tops.

1. Abacking tables K2 and K10 have continuous/contiguous tops; formed from a common stainless steel sheet or continuously welded / polished without butt joint / curb / backsplash.
2. Provide flat top with exposed edges having standard 1-1/2"x 90deg straight turn down and 1/2" toe-in on 30deg angle.

B. Shared Spanning Shelf; Provide, as detailed, centered between the abacking tables and equally overhanging each, a 120"L. X 18"D. fixed elevated shelf;

1. 18" above table top.
2. Flat top with 1" turn down and 1/2" toe-in at 30deg. at all exposed sides.
3. Provide with (2) - 1" x 4" x 1" x 14 ga. continuous length S/S reinforcing hat channels below the shelf to allow unsupported span of shelf between end supports.
4. Support the shared elevated shelf ends with 18"W. x 1-1/2" thick box supports. Provide double pan stainless steel supports with 16 ga. exterior pans, 20 ga. interior pans. Interior pans constructed with 90deg. x 1-1/2" returns at vertical sides. Exterior pans similar, inset to edges of interior pan edges. Top edge of interior pan turned outward 90deg for 1" and stud bolted to bottom of elevated shelf. Continuously weld bottom of support pans to Metal Top with exterior pan face flush to face edge of table.

C. Provide Electrical Receptacle boxes where shown, per standards. Electrical device(s), connection(s) and cover plate(s) by Other Trades.

1. Provide (2) under top Electrical Receptacle boxes, one at each end, where shown.
2. Provide under the elevated shelf (2) Electrical Receptacle boxes, where shown, per standards for Electrical Receptacles. Vertically mounted boxes below shelf with concealed routing of feed wires thru the shelf supports to the receptacle boxes.

D. Provide, a tier of (3) Drawers, at the staff right end, as shown, per standards, in Enclosed Cabinet Base.

E. As detailed and per standards, provide a Vertical Cutting Board Rack, on the staff right side of drawer enclose, where shown. Rack continuously welded to One each, an upper and lower inverted "L" 1" x 2" x 16 ga. S/S angles which are continuously welded between the front and rear table legs. Provide with (2) Carlisle model Sparta Spectrum Evershield high density polyethylene cutting boards with permanent NSF logo imprint. Hygienic surface texture, rounded corners, smooth on both sides. Provide 18" x 24" x 1/2" thick: color Red.

F. Provide Open Frame Base, per standards.

1. No front crossrails at under counter movable items.
2. Provide with standard 75" Stationary Undershelf to the staff left of the drawers, as shown.

G. Provide with Flanged Feet; Provide flanged feet on front legs, sealed & securely anchored to the floor.

ITEM NO. K11 - CABINET; ELEV DOOR DBL SIDED
REQUIRED

A. Provide Jamestown Metal Products model PT203-36 pass thru painted steel wall cabinet with double hinged doors with turn knob with integral latching mechanism on both sides. Overall 36"L. x 18"D. x 30"H. Fabricated of 18Ga. sheet steel as integral units, flush face joints, angle reinforced or welded corners, 1 1/4"W. exposed face rails and stiles with 3/4" x 1/2" rabbet for doors, finished ends. 5'8" thick insulated double pan doors with 18Ga. outer and 20Ga. inner heads, 14Ga. reinforced hinge attachment points, rubber door bumpers. Shelves adjustable on 1/2" centers, flanged down 1" all edges with front and back having 45 degree angle turn up back to bottom of shelf, supported on cadmium plated brackets inserted in slots in vertical supports. Satin chromium plated hardware, 5 knuckle institutional stainless steel hinges with lubricating spacers. Steel shall be treated with a heated alkaline base acid solution, rinsed with water and a coat of epoxy link applied, immediately dried in heated ovens, then gradually cooled prior to application of finish. Electrostatically apply epoxy powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory finish. Color Pepper Dust #415.

ITEM NO. L1 - STAND; EQUIPMENT
REQUIRED

A. Provide Pacific Stainless model MES243030FS*M112 Equipment Stand; overall 24"W. x 30"L. x 30"H. 16/304 stainless steel top reinforced with 14ga galvanized "HAT" channels; stainless steel under shelf welded to (4) each 1-5/8" S/S tube legs with S/S adjustable feet; fully assembled NSF.

ITEM NO. L2 - BUNN SLICER
REQUIRED

A. Provide Oliver model 723-N*M112. Overall 29 3/4" D x 16 1/8"W. White powder coat finish, chute and blade stainless steel. Bun height 3"; bun width 4 -38". Including bagel pusher, adjustable cutting blade, end feed chute.

ITEM NO. L3 - TABLE; BAKERS W/ DRAWERS
REQUIRED

A. Provide overall 120"L. x 30"D. x 34"H. to work top. Construct with S/S top in accordance with standard specifications for Metal Tops.

1. Abacking tables L3 and L10 have continuous/contiguous tops; formed from a common stainless steel sheet or continuously welded / polished without butt joint / curb / backsplash.
2. Provide staff side edge and exposed end edges with 1-1/2"x 90deg straight turn down and 1/2" toe-in on 30deg. angle.

B. Provide Can Opener, at the staff left end, near the front, where shown. Provide an Edlund model no. S-11*M112 manual stainless steel can opener, NSF certified, with cast S/S base, reversible S/S blade, dishwasher safe, opens cans to 14"H.

C. Provide, a tier of (3) Drawers, at the staff left end of the table, where shown, per standards, in Enclosed Cabinet Base.

D. As detailed and per standards, provide a Vertical Cutting Board Rack, on the staff right side of the drawer enclosure, where shown. Provide with (2) Carlisle model Sparta Spectrum Evershield high density polyethylene cutting boards with permanent NSF logo imprint. Hygienic surface texture, rounded corners, smooth on both sides. Provide 18" x 24" x 1/2" thick: color tan.

E. Provide Electrical Receptacle boxes where shown, per standards. Electrical device(s), connection(s) and cover plate(s) by Other Trades.

1. Provide (2) under top Electrical Receptacle boxes, (1) at each end, where shown.

F. Provide Open Frame Base, per standards.

1. No front crossrails at mobile / movable items.
2. Provide with standard 18" Stationary Undershelf to the staff right of the drawers, where shown.

G. Provide with Flanged Feet; Provide flanged feet on front legs, sealed & securely anchored to the floor.

ITEM NO. L4 - WASTE BARREL; UNDER COUNTER
REQUIRED

A. Provide Rubbermaid model FG354060-GRAY*M112 Slim Jim waste container with venting channels; overall 20"L x 11"W x 30"H. 23 gallon container; molded in handles; hi-impact plastic; open without lid; gray.

ITEM NO. L5 - INGREDIENT BINS; S/S 150 LBS - 31 GAL
REQUIRED

A. Provide Rubbermaid model no. FG360388*M112 Ingredient Bins; overall 29-3/4" x 18" x 28"H. White, seamless corrosion resistant construction with rounded corners, slant front clear hinged/sliding lid, 4.1 cu. ft. - 37 gallon capacity, 3" extra wide casters front fixed & rear swivel, 32 oz. scoop.

ITEM NO. L6 - MIXER; 40 QT FLOOR
REQUIRED

A. Provide Hobart Model No. HL400-4STD*M112, standard finish, with all standard accessories; overall footprint 23"W. x 30.25"D. X 49-7/8"H. 1.5HP heavy duty motor; gear transmission - gears are constant mesh heat-treated hardened alloy steel along with anti-friction ball bearings; grease lubricants furnished to all gears and shafts; three fixed speeds plus stir speed; shift-on-the-fly controls; patented soft start agitation technology sanitation; 20-minute smart timer; automatic time recall remembers the last time set for each speed; ergonomic swing-out bowl; bowl interlock ensures mixer bowl is properly in; removable stainless steel bowl guard; hobart quick release agitators; manual bowl lift, hand crank operated, self-locking in top and bottom position; powder coat finish; #12 attachment hub. Provide the following options;

1. Standard Accessory Package including 40 quart S/S bowl, "B" flat beater; "D" wire loop whip; "ED dough hook.
2. Painted cast iron bowl truck.

ITEM NO. L7 - MIXER; 60 QT FLOOR
REQUIRED

A. Provide Hobart model HL600, Legacy Planetary Mixer, 2.7 HP, 60-quart capacity; overall 28.647"W. X 40.658"D. X 61.302"H. Four fixed speeds; gear transmission; 50 min. Smart Timer; #12 attach hub; power bowl lift; bowl guard; shift on the fly controls with soft transition to higher speeds; swing out bowl. Provide the following accessories / options;

1. Standard Accessory Package Including:

    a. 60 Quart Stainless Steel Bowl
    b. 60 Quart aluminum "B" Flat Beater
    c. 60 Quart S/S "D" Wire Whip
    d. 60 Quart "ED" Dough Hook

2. One (1) HL1486*M112. Bowl truck for 60 qt mixers

ITEM NO. L8 - BOWL; 60 QT MIXER & DOLLY
REQUIRED

A. Provide Hobart HL60*M112, 60 QT stainless steel bowls.

B. Provide each bowl with Hobart HL1486*M112. Bowl truck for 60 qt mixers

ITEM NO. L9 - CABINET; ELEV DOOR DBL SIDED
REQUIRED

A. Provide Jamestown Metal Products model PT203-36 pass thru painted steel wall cabinet with double hinged doors with turn knob with integral latching mechanism on both sides. Overall 36"L. x 18"D. x 30"H. Fabricated of 18Ga. sheet steel as integral units, flush face joints, angle reinforced or welded corners, 1 1/4"W. exposed face rails and stiles with 3/4" x 1/2" rabbet for doors, finished ends. 5'8" thick insulated double pan doors with 18Ga. outer and 20Ga. inner heads, 14Ga. reinforced hinge attachment points, rubber door bumpers. Shelves adjustable on 1/2" centers, flanged down 1" all edges with front and back having 45 degree angle turn up back to bottom of shelf, supported on cadmium plated brackets inserted in slots in vertical supports. Satin chromium plated hardware, 5 knuckle institutional stainless steel hinges with lubricating spacers. Steel shall be treated with a heated alkaline base acid solution, rinsed with water and a coat of epoxy link applied, immediately dried in heated ovens, then gradually cooled prior to application of finish. Electrostatically apply epoxy powder coat of selected color and bake in controlled high temperature oven to assure a smooth, hard satin finish. Surfaces shall have a chemical resistant, high grade laboratory finish. Color Pepper Dust #415.

ITEM NO. L10 - TABLE; BAKERS W/ DRAWERS
REQUIRED

A. Provide overall 120"L. x 30"D. x 34"H. to work top. Construct with S/S top in accordance with standard specifications for Metal Tops.

1. Abacking tables L3 and L10 have continuous/contiguous tops; formed from a common stainless steel sheet or continuously welded / polished without butt joint / curb / backsplash.
2. Provide staff side edge and exposed end edges with 1-1/2"x 90deg straight turn down and 1/2" toe-in on 30deg. angle.

B. Shared Spanning Shelf; Provide, as detailed, centered between the abacking tables and equally overhanging each, a 120"L. X 18"D. fixed elevated shelf;

1. 18" above table top.
2. Flat top with 1" turn down and 1/2" toe-in at 30deg. at all exposed sides.
3. Provide with (2) - 1" x 4" x 1" x 14 ga. continuous length S/S reinforcing hat channels below the shelf to allow unsupported span of shelf between end supports.
4. Support the shared elevated shelf ends with 18"W. x 1-1/2" thick box supports. Provide double pan stainless steel supports with 16 ga. exterior pans, 20 ga. interior pans. Interior pans constructed with 90 degree x 1-1/2" returns at vertical sides. Exterior pans similar, inset to edges of interior pan edges. Top edge of interior pan turned outward 90deg for 1" and stud bolted to bottom of elevated shelf. Continuously weld bottom of support pans to Metal Top with exterior pan face flush to face edge of table.

C. Provide Electrical Receptacle boxes where shown, per standards. Electrical device(s), connection(s) and cover plate(s) by Other Trades.

1. Provide (2) under top Electrical Receptacle boxes, (1) at each end, where shown.
2. Provide Two (2) under elevated shelf Electrical Receptacle boxes, where shown, per standards for Electrical Receptacles. Vertically mounted boxes below shelf with concealed routing of feed wires thru the elevated shelf supports to the boxes.

D. Provide, a tier of (3) Drawers, at the staff right end, where shown, per standards, in Enclosed Cabinet Base.

E. As detailed and per standards, provide a Vertical Cutting Board Rack, at staff left side of the drawers, where shown. Rack continuously welded to One each, an upper and lower inverted "L" 1" x 2" x 16 ga. S/S angles which are continuously welded between the front and rear table legs. Provide with (2) Carlisle model Sparta Spectrum Evershield high density polyethylene cutting boards with permanent NSF logo imprint. Hygienic surface texture, rounded corners, smooth on both sides. Provide 18" x 24" x 1/2" thick: color white.

F. Provide Open Frame Base, per standards.

1. No front crossrails at mobile / movable items.
2. Provide with standard 18" Stationary Undershelf to the staff left side of the drawers, where shown.

G. Provide with Flanged Feet; Provide flanged feet on front legs, sealed & securely anchored to the floor.

ITEM NO. L11 - DOUGH DIVIDER MANUAL AND STAND
RELOCATED

A. Relocate from the current high school central kitchen a Dutchess model BMIH-36 manual dough divider and stand; overall 18.5"W. X 14"D.

ITEM NO. M1 - DISH TABLE; SOILED
REQUIRED

A. Provide as shown, an 115"L. x 30"D. x 34"H. from dish table top to floor.

B. Construct top in accordance with standard specifications for Dish Table Tops.

1. Slope for positive drainage.
2. Lip top into dishwasher in watertight manner per dish machine manufacturers recommendations.
3. 3"H x 1-1/2" semi-rolled rim at exposed staff side and staff left end.
4. 8"H. x 2"W. sloped top splash at abacking wall with 1/2" turn down at wall and closed ends.
5. Punch top and continuously weld in Item M2.
6. Punch back splash from Item M2 pre-rinse spray.

C. Provide Open Frame Base, per standards.

1. No front crossrails at mobile / movable items.
2. Provide with standard 28" Stationary Undershelf at the staff left end, as shown.

ITEM NO. M2 - COLLECTOR; FOOD WASTE
REQUIRED

A. Provide Salvajor model P914 scrapping, pre-flushing & collecting system; overall 38-1/2"L. X 24-1/2"D. x 34"H. Tank and legs of stainless steel; removable, lightweight tableware salvage basin designed to trap tableware of all types; removable, lightweight perforated scrap basket designed to retain fibrous waste; water recycling 3/4HP centrifugal pump with corrosion resistant housing and impeller; corrosion resistant pre-plumbed water control assembly including pre-wired solenoid valve, automatic water blender, back flow preventing check valves, unions, 1/2" shut-off valves; model SS-33 motor controller in NEMA 4X watertight corrosion resistant enclosure with magnetic contactor, 24 volt Safety Circuitry, line disconnect, start-stop push buttons, run light.

1. Provide with control panel mounting bracket.
2. Water plume to staff right end of unit.

B. Centered behind collecting system bowl, provide back splash spring type pre-rinse spray. 8" centers dual valve back splash mount, flexible stainless steel hose wrapped with stainless steel support spring with wall bracket to adjacent wall.

1. Fisher Model 13390*M112; Ultra spray with fan style 1.15 GPM spray head & valve.
2. T & S model B-0133*M112 with B-0107-J, fan style 1.1 gpm spray head & valve.

C. Provide dish rack slide bar over top of waste collector. Removable 16 ga. S/S - 1/2" x 1_1/2" x 1/2" channel at 19" from the staff side dish table rolled rim. Channel inverted with top flush to dish table top, resting on 1-3/8"L. x 1/2"H. x 12 ga. S/S plates continuously welded to interior walls of collector.

ITEM NO. M3 - WAREWASHER; RACK CONVEYOR W/ BOOSTER HEATER, DWT
REQUIRED

A. Provide Hobart Model CLPS - 66E*M112, Conveyor Dishwasher with power scrapper, left to right operation; overall 66-3/4"W. X 30-1/4"D. X 68-1/2"H. Single tank; 202 racks/hour; Energy Star rated with water usage of .62 gallons per rack; insulated hinged doors; S/S enclosure panels; Low Temperature & Dirty Water Indicators; 19.5" chamber height opening accommodates 18 x 26 sheet pans; top mounted micro-processor control module; energy saver mode; low temperature alert; conveyor dwell; delime notification; service diagnostics; stainless steel self-draining pumps and impellers; single point electrical connection; vent fan and booster heater control. Furnish with all standard equipment in accordance with manufacturers standard specifications. Provide the following options:

1. 480/60/3 (CLPS66E-ELE0CD)
2. Electric tank heat 15kw (CLPS66E-HTE15K)
3. 30KW booster Heater

4. Left to Right operation (CLPS66E-DIR0LR)
5. 6" Higher than standard (CLPS66E-HGTHTS) pre-rinse, washing and rinse compartments.
6. Provide Two (2), with one at each end, E-series extended hood dom (EXTHD/E-DOM). Stainless steel extended vent hoods with vent stack and locking damper.
7. Provide Four (4) Racks, bun pan (BUNPAN-RACK) tray racks with chrome plated wire insert for supporting (3) 18" x 26" pans through standard height dish machines.
8. Drain water tempering kit (DWT1)
9. Single point electrical connection.
10. Vent fan switch.

B. Furnish and install with dishwasher, from extended vents, One (1) at each end 20 ga. 4" x 16" stainless steel duct and extend to 3" above finish ceiling, with 1" stainless steel perimeter trim at ceiling.

C. As detailed, fabricate 16ga. S/S, 10"W. Dish Machine Splash Guards extending down from the extended vent hoods at entry end front and exit end front and back. Bolted to the 45deg bottom face of the extended vent hoods, the closure panels shall turn downward at the inside edge of the hood, extending to 1" above the dish table top. Seal closures to rolled rims and face edge of dish machine.

D. Provide Traex Rack-Master (4) way indexed dishwasher racks; open bottoms & sidewalls; handles on all four sides; co-polymer beige plastic with double wall construction; snap fit extenders. Provide the following models;

1. Four (4) model TR-1, full size pot / pan / glass ware rack, 3-1/4" inside height, flat open bottom.
2. Four (4) model TR-2, full size flatware rack, 3-1/4" inside height, open bottom with mesh design.
3. Four (4) model TR-3, full size peg rack for plates & trays, 3-1/4" inside height.

ITEM NO. M4 - WALL FAN; TRAY DRYING
REQUIRED

A. Provide J & D Manufacturing 18" white waterproof fan with wall ceiling mount bracket (available through Global Industrial stock WC968709). UL507 certified waterproof motor; hanging wall/ceiling yoke bracket to allow tilt angle adjustments; overall 22"L. X 24"W. X 11"H. 3-speed 1/3 HP enclosed motor with sealed ball bearings and automatic thermal overload protection; white powder coat finish with (3) painted fan blades; 12' - 3 conductor power cord. Securely mount to wall, where shown, at 78"AFF to bottom of grill. Secure per manufactures recommendations for the wall substrate. Position aimed downward towards back edge of clean dish table.

ITEM NO. M5 - DISH TABLE; CLEAN
REQUIRED

A. Provide as shown on drawing, overall 114"L. x 30"D. x 34"H. from dish table top to floor.

B. Construct top in accordance with standard specifications for Dish Table Tops.

1. Slope top from positive drainage.
2. Lip top into dishwasher in watertight manner.
3. Standard Backsplash, 8"H. x 2"W. with 45deg upward sloped top, 1/2" turn down at wall with closed ends.
4. Semi-rolled rim at exposed staff side and staff right end; 3"H. with 1-1/2" semi-rolled rim.

C. Mount top on standard Open Frame Base.

1. Provide standard Removable Undershelf, 60"L. extending from the staff right end.

ITEM NO. M6 - SINK; (3) COMP W/ SCRAP SINK
REQUIRED

A. Provide overall. 11'-4"L. x 30"D x 34" high to work top. Construct in accordance with standard specifications for Rolled Rim Sinks.

1. 3"H x 1-1/2" semi-rolled rim at exposed staff side and each end.
2. 10"H. x 2"W. splash at abacking wall with 45deg. upward sloped top, 1/2" turn down at wall and closed ends.

B. Sink configuration from the staff right end;

1. 24"W. cantilevering right end drain board
2. (1) - 28"W x 26.5"D x 6"H. scraping bowl with bottom mounted 6"W. X 26 ½"D. X 6"H. Waste Collection Well having a removable Waste Collection Pan;
3. (3) - 20"W. X 26 1/2"D. X 12"H. wash, rinse and sanitize bowls.
4. 24"W. cantilevering left end drain board.

C. The Waste Collection Well extends 6" down from scrapping bowl bottom (overall 12"H.). In the well, provide a removable S/S waste Collection Pan, 5.5"W. x 2'-2"D. X 5"H. Waste collection pan constructed of 18 ga. 304 S/S with 1/4" diameter holes in bottom and sides at 3/4" O.C. max. Provide with a 1/2"Dia. S/S rod, approx. 5.5"L., across the pans width, near the upper pan lip and centered in the collection pans depth. Rod to function as a lift handle for pan removal. Provide Four (4) - 1/4"L. x 1/8" dia. studs welded to the bottom of the pan, One at each corner to support the pan 1/4" off the bottom of the waste collection well.

D. Provide centered on wash/rinse/sanitize sink partitions, (2) - 3/4" x 8"O.C. Open Body Back Splash Faucets, with 10" or 12" swing spout, chrome finish;

1. Fisher Mfg. Co. Model 5412*M112 (10" swing spout)
2. T&S Brass model B-0290*M112.

E. Provide behind the scraping bowl, where shown, a Back Splash Mount Spring Type Pre-rinse Spray; 8" centers dual valve back splash mount, flexible stainless steel hose wrapped with stainless steel support spring with wall bracket to adjacent wall.

1. Fisher Model 13390*M112; 1.15 GPM consumption.
2. T & S model B-0133*M112 with B-0107-J, fan style 1.1 gpm spray head & valve

F. Provide the Three (3) wash/rinse/sanitize bowls with Fisher Mfg. Co., 22209*M112 - 2" rough chrome rotary ball action lever drains having stainless steel bar and flat stainless steel strainer plate. Provide each with 6" tail piece.

G. Provide in the bottom of the Waste Collection Well, a Fisher model 6556 drain with removable basket strainer. 4-1/2" diameter for 3 1/2" opening, chrome plated brass body, brass clamping ring, stainless steel basket with drain plug.

H. Sink mounted on standard Open Frame Base with no front cross rail.

ITEM NO. M7 - HAND SINK; FOOT PEDAL
REQUIRED

A. Provide Advance Tabco Model No. 7-PS-71*M112, overall 17-1/4"L. x 15-1/4"D. X 13"H. 304 stainless steel, with deep drawn 10"front-to-back x 14"W x 5" bowl, recessed no drip edge. Includes; heavy gauge galvanized mounting bracket, 1-1/2" stainless steel basket drain. Provide with the following;

1. K-121 Faucet, splash-mount, gooseneck
2. 7-PS 36 -Side mounting wall brackets for added strength.
3. 7-PS-17 -Side Splashes, for hand sinks, (2) - splashes, (1) on each side.
4. Provide .5 GPM Low flow faucet aerator(s).

B. Provide with T&S model B-0504-02 Double Pedal Valve, wall mounted, inlets on 2 1/2" centers, 1" from wall to center of inlets, wall to pedal tips approx. 13 3/4", angle loose key stops, top mounted volume control straight loose key stop. Provide wall blocking support as necessary.

C. Soap & towel dispenser & Waste receptacle (By Owner)

ITEM NO. M8 - HOSE REEL; UNDER COUNTER
REQUIRED

A. Provide as detailed, exposed reel rinse with spray valve, mounting base & hose support arm rotated with hose off top of reel and spray head supported off the floor.

1. Stainless Steel Exposed Hose Reel; Exposed reel rinse w/spray valve; all stainless steel; 35 feet of 3/8" ID, 3 ply, 2 braid hose, working pressure of 150 PSI & withstands 140deg F water temp., 1/2" NPT female; adjustable arm positions allow ceiling, wall, under counter mounting.

a. Fisher Mfg. model 29599*M112 hose reel with 32840 spray gun.
b. Equivalent by T&S.

B. Provide adjacent to reel rinse, where shown, a 12 ga. S/S fixture support bracket, 8"W. x 6"H.

Provide with 60deg top to bottom tapered sides turned back 90deg. from the face. Top of side to have 1" 90deg inward return which welds to table bottom. Face of bracket punched for control valve. Radius bottom corners 1/2".

1. Rear Feed Control Valve; Provide 3" or 4" center to center remote control valve with internal spring loaded checks; rear supply and rear feed connections; lever handles;

   a. Fisher model 2805-CV*M112
   b. T&S model B-0513*M112 with Two (2) B-CVH-1/2 check valves.

2. Backflow prevention required (By Other Trades)

C. Weld stud bolts to drainboard under side, secure hat channels for reel rinse mounting, mount reel rinse and control valve bracket.

2.4 LIST OF EQUIPMENT – HIGH SCHOOL FACS AND PRE-K

ITEM NO. A1 - SOLID DOOR REACH-IN REFRIGERATOR
REQUIRED

A. Provide True Food Service Equipment model TS-23-HC Reach-In Solid Swing Door Refrigerator with Hydrocarbon Refrigerant. Overall 78-3/8”H. x 29-1/2” L. x 29-1/2”W. Factory-engineered, self-contained, capillary tube system using R290 hydrocarbon refrigerant. Stainless steel exterior, sides and doors. Clear coated aluminum liner with stainless steel floor with covered corners. Heavy duty PVC coated shelves. Positive seal self-closing doors. Interior safety-shielded lights Automatic defrost system time-initiated, temperature-terminated.

1. Provide five (5) additional shelves.

ITEM NO. A2 - TRANSPORT CABINET; INSULATED, HALF-SIZE
REQUIRED

A. Provide Cres Cor model 309-188C, 23-7/8”W x 32-1/4”D x 33-7/8”H on 5” diameter casters. .063” aluminum inner, outer, top liner and formed door: body reinforced with extruded channels; fully insulated with 1-1/2” fiberglass, field reversible door with spring compression transport latch and perimeter neoprene gasket; lift out 18 ga. 304 stainless steel wire slides on 2-3/4” centers for 18” x 26” and 12” x 20” pans.

1. Provide eight (8) Kold Keepers.

ITEM NO. A3 - HOT CABINET; INSULATED
REQUIRED

A. Provide Cres Cor model H-135-WUA-11, 25-3/4”W x 33-1/2”D x 69-3/4”H on 5” diameter casters. Electromechanical thermostat (holding) and thermometer. Electromechanical thermostat (humidity). .063” aluminum inner, outer, top liner and formed doors; body reinforced with extruded channels; fully insulated with 1-1/2” fiberglass, field reversible dutch doors with full view windows and magnetic type latch and perimeter neoprene gasket; wire

angle slides mounted on lift-off posts, spaced at 4-1/2" centers; adjustable on 1-1/2" centers. (2) 960 -watt heaters for holding. Water pan: 3 ½ quart; 22 ga, stainless steel with 960 watt heater for humidity; blower motor; lighted on/off switch; cord and plug set.

ITEM NO. A4 - HOT CABINET; INSULATED, HALF-SIZE
REQUIRED

A. Provide Cres Cor model H-339-UA-8C, 28-1/16"W x 32-1/4"D x 36-11/16"H on 5" diameter casters. Solid state thermostat and thermometer. .063" aluminum inner, outer, top liner and formed door: body reinforced with extruded channels; fully insulated with 1-1/2" fiberglass, field reversible door with spring compression transport latch and perimeter neoprene gasket; lift out 18 ga. 304 stainless steel wire slides on 2-3/4" centers for 18" x 26" and 12" x 20" pans. (3) 300-watt concealed heating elements provide up to 200 deg heating capacity, lighted on/off switch; cord and plug set; two bale handles on each side.

ITEM NO. A5 - HOOD; TYPE 1 WITH FIRE SUPRESSION
BY OTHER TRADES

ITEM NO. A6 - RANGE; 6-BURNER W/ CONVECTION OVEN
REQUIRED

A. Provide Southbend model TVGS/12SC. P36N-BBB; Six 35,000 BTU NAT patented clog-free burners, removable welded steel top grates, 9-1/4" deep front rail, removable drip tray, stainless steel front, sides, rear, and exterior bottom, fully insulated lining and burner box. TruVection oven, non-clog inshot burners, 52,000 BTU NAT single deck, interior light, coved porcelain interior, cool touch stainless steel door handles; two-speed ½ hp fan motor; 5 position rack guides and 3 plated oven racks, bottom rack is roller bearing; electronic ignition, cool down fan mode; standard controls – 150degF to 550degF solid state thermostat and 60 minute mechanical cook timer; doors with windows; single standard shelf; 24" flue riser; 6" casters.

1. Electrical: 120/60/1 phase, furnished with 6' power cord with 3-prong plug (1 plug/deck). NEMA #5-15p.

ITEM NO. A7 - RANGE; GRIDDLE W/ COMVECTION OVEN
REQUIRED

A. Provide Southbend model TVGS/12SC. P36N-GGG; 36" griddle - Six 35,000 BTU NAT burners with three control knobs, "Insta-On" thermostatic control of griddle surface temperature in the range 180degF to 400degF, electric pilot ignition, 9-1/4" deep front rail, 1" thick griddle plate with side and rear splashers, removable stainless steel grease drawer, stainless steel front, sides, rear, and exterior bottom. TruVection oven, non-clog inshot burners, 52,000 BTU NAT single deck, interior light, coved porcelain interior, cool touch stainless steel door handles; two-speed ½ hp fan motor; 5 position rack guides and 3 plated oven racks, bottom rack is roller bearing; electronic ignition, cool down fan mode; standard controls – 150degF to 550degF solid state thermostat and 60 minute mechanical cook timer; doors with windows; single standard shelf; 24" flue riser; 6" casters.

1. Electrical: 120/60/1 phase, furnished with 6' power cord with 3-prong plug (1 plug/deck). NEMA #5-15p.

ITEM NO. A8 - TABLE; WORK
REQUIRED

A. Provide Advance Tabco model TMS-305 flat top work table. Overall 30" W x 60" L x 28" H to table top. 16ga/304 stainless steel top with 1-5/8" sanitary rolled edges front and back and square side edges; 1-5/8" dia tubular stainless steel stretchers; 1-5/8" tubular stainless steel legs; stainless steel gussets; 1" adjustable stainless steel bullet feet; sound deadened top; open base design.

ITEM NO. A9 - FRYER; COUNTERTOP
REQUIRED

A. Provide Wells model LLF-14, overall 11"W x 21-7/8"D x 12-5/6". Stainless steel top, front, and sides. Deep drawn, removable, stainless steel, 14 lb. oil capacity fry pot. Two (2) half size fry baskets, ½" adjustable legs, 0ne-piece, swing-up tubular elements; positive-off, operator adjustable thermostat; safety high limit thermostat with indicator light and manual re-set. 4 foot power cord.

1. 120V with NEMA 5-15P plug.

ITEM NO. A10 - MICROWAVE OVEN; STEAMER
REQUIRED

A. Provide Panasonic model NE-2180; overall 25-9/16" W x 20-3/4"D x 18-9/16"H, stainless steel cabinet and cavity; 1.6 cubic foot capacity; 2100 watts output power; equipped with 4 magnatrons, top and bottom energy feed,; door opens down to hold pans; removable center shelf; 8 programmable pads; 16 memories, shift key, 3-stage cooking, 5 power levels, programmable lock, cycle counter, volume/tone, self diagnostics, dial type timer, easy clean air filters.

1. 208V/60 Hz/1 ph, NEMA 6-30R receptacle.

ITEM NO. A11 - TABLE; MIXER STAND
REQUIRED

A. Provide Advance Tabco model MX-SS-242 Mixer Stand; Overall 24' W x 24" D x 78" H, Mixer table top 24" above floor. 14/304 stainless steel top with galvanized understructure; stainless steel undershelf welded to (4) each 1-5/8" dia. stainless steel tube legs with stainless steel adjustable feet; 1-5/8" dia. stainless steel tube utensil rack with stainless steel hooks.

ITEM NO. A12 - BENCH MIXER; 20-QUART
REQUIRED

A. Provide Globe model SP20. Overall 18-1/4" W x 19-1/2"D x 34-1/2"H. Constructed of rigid cast-iron body with front-mounted controls, digital 60-minute timer, last batch recall; ½ hp motor with overload protection and gear-driven, high torque permanently lubricated transmission of heat-treated hardened steel alloy gears and shafts; 20 quart stainless steel bowl, aluminum flat beater, stainless steel wire whip, aluminum dough hook, non-slip rubber feet; interlocked, removable stainless steel bowl guard with fully welded on ingredient chute; #12 attachment hub and interlocked bowl lift.

ITEM NO. A13 - INGREDIENT CART; 3 BIN
REQUIRED

A. Provide Channel Manufacturing Co. model 123P Ingredient Bins and Cart; overall 28"H x 17-1/2"W x 31"D; smooth, seamless, rigid polyethylene liner, white, yellow, and blue bins with clear covers, 50 lb. capacity per bin, all-welded mobile aluminum cart with (4) 5" dia. casters with caster brakes.

ITEM NO. A14 - TABLE; WORK
REQUIRED

A. Provide overall 120"L x 30"D x 36" H to work top. Construct top in accordance with standard specifications for Metal Tops.

1. **Provide square edge at back where table abacks A14.**
2. **Provide 3/4"H. inverted "V" edge at exposed table edges. Turn down "V" edge 1-1/2", and 1/2" toe-in on 30deg angle.**

B. Provide electrical receptacle boxes where noted, per standards. Electrical device connections and cover plates by Other Trades.

1. **Provide (2) under top Electrical Receptacle boxes, (1) at each end.**

C. Provide Open Frame Base, per standards.

1. **No front crossrails at under counter serviceable or mobile/movable items.**
2. **Provide with standard full width Stationary Undershelf, staff right.**

E. Provide with Flanged Feet; Provide flanged feet on front legs, sealed and securely anchored to the floor.

ITEM NO. A15 - RACK; TALL PAN
REQUIRED

A. Provide Channel Manufacturing Co., model UTR-12 Bun Pan Rack; overall 20-1/2"W x 26"D x 70" H. 1" square tubular frame of Type 6063-T5 alloy heavy duty, high tensile extruded aluminum construction; 3-1/4" wide pan slides to accommodate (12) 18" x 26" trays or 12" x 20" steamtable pans; (4) 5" dia. full swivel casters with caster brakes.

ITEM NO. A16 - COMBINATION FOOD PROCESSOR
REQUIRED

A. Provide Robot Coupe model R 502 Combination Processor, overall 14-3/16" W x 14-9/16"D x 24-5/16" H. 3 HP motor: 850 rpm and 1725 rpm operating speeds, 5.5 qt. stainless steel cutter bowl and smooth bowl base blade assembly; metal vegetable preparation attachment with side ejection equipped 1 large and 1 cylindrical hopper; magnetic safety and switch; mashed potato function capable of producing 20 lbs of mashed potatoes in 2 minutes; 3 mm grating and 3 mm slicing discs. Provide the following additional accessories:

1. **1 each 0.8 mm slicing disc**
2. **1 each 2 mm slicing disc**

3. 1 each 5 mm slicing disc
4. 1 each 2 mm grater
5. 1 each 5 mm grater
6. 1 each 5 x 5 x 5 mm dicing disc
7. 1 each 10 x 10 x 10 mm dicing disc
8. 1 each 5 14 x 14 x 14 mm dicing disc
9. 1 each 2.5 x 2.5 mm julienne stick
10. 1 each 2 x 10 mm julienne stick
11. 1 Cleaning Kit
12. 2 disc holders

ITEM NO. A17 - TABLE; WORK REQUIRED

A. Provide overall 120"L x 30"D x 36" H to work top. Construct top in accordance with standard specifications for Metal Tops.

1. **Provide square edge at back where table abacks A14.**
2. **Provide 3/4"H. inverted "V" edge at exposed table edges. Turn down "V" edge 1-1/2", and 1/2" toe-in on 30deg angle.**

B. Provide centered at 29" from staff left end. a standard Metal Top integral sink. Sink, 20" W x 20" D x 12" H.

1. **Provide sink with 1/2" Single Hole Deck Mount Faucet: 1/2" double valve faucet with 10" or 12" swing spout, chrome finish;**

   a) **Fisher Mfg. Co. 3112 or 3113.**
   b) **T&S Brass model B-0200-LN 061X swivel nozzle or B-0201.**

2. **Provide the sink bowl with Fisher Mfg. Co., 22209, 2" rough chrome rotary ball action lever drain having stainless steel bar and flat stainless steel strainer plate. Provide with 6" tail piece.**

C. Provide electrical receptacle boxes where noted, per standards. Electrical device connections and cover plates by Other Trades.

1. **Provide (2) under top Electrical Receptacle boxes, (1) at each end.**

D. Provide Open Frame Base, per standards.

1. **No front crossrails at under counter serviceable or mobile/movable items.**
2. **Provide with standard 52" Stationary Undershelf, staff right.**

E. Provide with Flanged Feet; Provide flanged feet on front legs, sealed and securely anchored to the floor.

ITEM NO. A18 - SCALE; PORTION CONTROL
REQUIRED

A. Provide Detecto model PS-7 Portion Control Scale, overall 2.44" H x 8.03"W x 7.87"D. Platform size 8.02"W x 4.96"D. 5-digit display with 0.8" x 0.3" characters with fractions LCD; Capacity: 7 lb x 0.1 oz / 112 oz x 0.1 oz / 112 oz x 1/8oz / 3000g x 1g / 7 lb x 0.005 lb. A/C or battery power option.

ITEM NO. B1 – DISH TABLE, CLEAN
REQUIRED

A. Provide as shown on drawing, overall 64” L x 30”D x 34”H from dish table top to floor.

B. Construct top in accordance with standard specifications for Dish Table Tops.

1. **Slope top from positive drainage.**
2. **Lip top into dishwasher in watertight manner.**
3. **Standard Backsplash, 8”H x 2” W with 45 deg upward slope top, 1/2” turn down at wall with closed ends.**
4. **Semi-rolled rim at exposed staff side left end; 3”H with 1-1/2” semi-rolled rim.**

C. Mount top on standard Open Frame Base.

1. **Provide Standard Removable Undershelf, 48” long extending from the staff left end.**

ITEM NO. B2 - DISHWASHER; VENTLESS, TALL
REQUIRED

A. Provide Hobart Model am15VLT, Advansys Ventless Tall Dishwasher w/ 70deg. F rise electric booster heater. Overall 90” H x 30” W. x 30.75” D. 40 racks/hour, .74 gallons per rack final rinse water, stainless steel drawn tank, tank shelf, chamber, trim panels, feet and frame; 27” door opening for 18” x 26” sheet pans. Solid state integrated controls with digital status indicators, delime notification, service diagnostics, door actuated start, self-draining, high efficiency stainless steel pump and stainless steel impeller; single point electrical connection. Furnish with all standard equipment in accordance with manufacturers standard specifications. Provide the following options:

1. **208/30/3**
2. **8.5 KW electric booster heater**

B. Provide Vollrath Company, Signature Model 52669 Insulated Tray and Steam Table Pan Rack with chrome-plated insert – standard height open end with stainless channel. Insert is free floating. Three (3) required.

C. Provide Traex dishwasher racks; open bottoms and sidewalls, handles on four sides; co-polymer beige with double wall construction. Provide the following models:

1. **Three (3) model TR1, full size pot / pan/ glassware rack, 3-1/4” inside height, flat open bottom.**
2. **Three (3) model TR3, full size peg rack for plates and trays, 3-1/4” inside height.**

3. **Three (3) model TR2, full size flatware rack, 3-1/4" inside height, open bottom with mesh design.**

ITEM NO. B3 – DISH TABLE W/ SCRAP SINK AND 3 COMPARTMENT SINK REQUIRED

A. **Provide as shown on drawing, overall 108" L x 30" D x 34" H from dish table top to floor.**

B. **Construct top in accordance with standard specifications for Dish Table Tops.**

1. **Slope top from positive drainage.**
2. **Lip top into dishwasher in watertight manner per dish machine manufacturers recommendations.**
3. **Standard Backsplash, 8" H x 2" W with 45 deg upward slope top, ½" turn down at wall with closed ends.**
4. **Semi-rolled rim at exposed staff side left end; 3" H with 1-1/2" semi-rolled rim.**
5. **Punch top and continuously weld in scrap sink, 10" W x 22" L x 8" D drawn stainless steel scrap sink with 1-1/2" drain outlet and removable scrapping basket.**
6. **Punch top and continuously weld in three (3) sinks, 20" W x 22" L x 12" D drawn stainless steel scrap sink with 1-1/2" drain outlet.**
7. **Centered behind scrapping sink, provide backsplash type pre-rinse spray. 8" centers dual backsplash mount, flexible stainless steel hose wrapped with stainless steel support spring with wall bracket to adjacent wall.**

    a. **Fisher Model 13390*M112; Ultra spray with fan style 1.15 GPM spray head and valve.**
    b. **T & S model B-0133*M112 with B-0107-J, fan style 1.1 GPM spray head and valve.**

8. **Centered between deep sink basins, provide backsplash type gooseneck type faucets. 8" centers dual backsplash mount, with wrist blade handles.**

C. **Provide Open Frame Base, per standards**

ITEM NO. B4 - HAND SINK REQUIRED

A. **Provide Advance Tabco Model No. 7-PS-68, overall 17-1/4" L x 15-1/4" D x 13" H; 304 stainless steel, with deep drawn 10" front-to-back x 14" W X 5" bowl, recessed no drip edge. Includes heavy gauge galvanized mounting bracket, 1 ½" stainless steel basket drain. Provide with 4" O.C. splash mounted gooseneck faucet with wrist handles and .5 GPM low flow faucet aerator.**

ITEM NO. C1 - REACH-IN FREEZER; 2-DOOR REQUIRED

A. **Provide True Food Service Equipment model TS-43F Reach-In Solid Swing Door Stainless Steel -10 deg F Freezer. Overall 78-3/8" H x 47" L x 29-1/2" W. Stainless steel interior and exterior, sides and doors. Heavy duty PVC coated shelves. Positive seal self-closing doors. Automatic defrost system time-initiated, temperature-terminated.**

ITEM NO. C2 - SOLID DOOR REACH-IN REFRIGERATOR
REQUIRED

A. Provide True Food Service Equipment model TS-23-HC Reach-In Solid Swing Door Refrigerator with Hydrocarbon Refrigerant. Overall 78-3/8" H x 29-1/2" L x 29-1/2" W. Factory-engineered, self-contained, capillary tube system using R290 hydrocarbon refrigerant. Stainless steel exterior, sides and doors. Clear coated aluminum liner with stainless steel floor with covered corners. Heavy duty PVC coated shelves. Positive seal self-closing doors. Interior safety-shielded lights Automatic defrost system time-initiated, temperature-terminated.

1. Provide five (5) additional shelves.

ITEM NO. C3 - SHELVING
REQUIRED

A. Furnish, assemble and set in place, the following stationary storage system shelving, as manufactured by Intermetro Industries Corp. Shelving design and model numbers are based on Metro, Super Erecta Shelf wire shelving, chrome finish, with all standard parts and accessories necessary for a complete installation. Units comprised of the following:

1. Each unit constructed with 74 5/8" high posts.
2. Provide each unit with (4) shelves. Install shelves at 6" - 28" - 50" - 72" AFF.
3. Provide "S" clips at perpendicular setting shelves to avoid posts located in interior corners.
4. Two (2) units comprised of 1842NC shelves, 24" x 36".
5. Two (2) units comprised of 2448NC shelves, 24" x 48".

ITEM NO. C4 - SHELVING; SECURITY CAGE
REQUIRED

A. Furnish, assemble, and set in place the following mobile security cages as manufactured by Crown Brands. Unit design based on Crown Brands Chrome Security Cages model 10004, wire shelving, chrome finish, side and back panels, lockable front doors, (2) shelves, split posts with sleeves, (2) swivel casters and (2) swivel casters with brakes with all parts and accessories necessary for a complete installation. Units comprised of the following:

1. Three (3) units, model 10004, overall 48"W x 24" D x 68" H.

ITEM NO. D1 - TABLE; MOVEABLE STUDENT
REQUIRED

A. Provide Advance Tabco model TMS-245 flat top work table. Overall 24" W x 60" L x 36" H to table top. 16ga/304 stainless steel top with TA-22 square edges; 1-5/8" dia tubular stainless steel stretchers; 1-5/8" tubular stainless steel legs; stainless steel gussets; 1" adjustable stainless steel bullet feet; sound deadened top; open base design.

1. Provide two (2) coat hooks stud bolted to table underside above cross rail at each table.

ITEM NO. D2 - TABLE; MOVEABLE STUDENT - ACCESSIBLE
REQUIRED

A. Provide Advance Tabco model TMS-245 flat top work table. Overall 24" W x 60" L x 34" H to table top. 16ga/304 stainless steel top with TA-22 square edges; 1-5/8" dia tubular stainless steel stretchers; 1-5/8" tubular stainless steel legs; stainless steel gussets; 1" adjustable stainless steel bullet feet; sound deadened top; open base design.

1. Provide two (2) coat hooks stud bolted to table underside above cross rail at each table.

ITEM NO. E1 - HAND SINK
REQUIRED

A. Provide Advance Tabco Model No. 7-PS-68, overall 17-1/4” L x 15-1/4” D x 13” H. 304 stainless steel, with deep drawn 10” front-to-back x 14” W X 5” bowl, recessed no drip edge. Includes heavy gauge galvanized mounting bracket, 1-1/2” stainless steel basket drain. Provide with 4” O.C. splash mounted gooseneck faucet with wrist handles and 0.5 GPM low flow faucet aerator.

ITEM NO. E2 - RESIDENTIAL ELECTRIC RANGE/OVEN; CERAMIC COOKTOP
REQUIRED

A. Provide Whirlpool model WEE510SOFS Guided electric front control range with Easy-Wipe Ceramic Glass cooktop. Overall 37" H. x 29-7/8" W x 28-15/16" D. Slide-in type. ADA Compliant height and operation compliant. 2400 Watt bake element. 1 oven light; 2 wire oven racks; 5 oven rack guides. Front electronic touch oven control location; adjustable self cleaning cycle. removable oven door with extra large window; Front cooktop control location; glass smoothtop element style; heating element on indicator light; hot surface indicator light. 3000 watt max element burner power. 1 dual size 9"/6" element burner, 1- 9" element burner, 2 -6" element burners.

1. Provide manufacturer approved power cord.

ITEM NO. E3 - RESIDENTIAL ELECTRIC RANGE/OVEN; RESISTANCE COIL COOKTOP
REQUIRED

A. Provide Whirlpool model WEC310S0FS Guided electric front control coil range. Overall 37" H x 29-7/8" W x 28-15/16" D. Slide-in type. ADA Compliant height and operation compliant. 2400 Watt bake element. Top of oven broiler location.1 oven light; 2 wire oven racks; 5 oven rack guides. Front electronic touch oven control location; adjustable self cleaning cycle. Removable oven door with extra large window; Front cooktop control location; coil type elements; porcelain coated steel cooktop surface material; heating element on indicator light. 2600 watt max element burner power. 2- 8" coil burners, 1 - 4" coil burner, 1 - 6" coil burner.

1. Provide manufacturer approved power cord.

ITEM NO. E4 - RESIDENTIAL GAS RANGE/OVEN
REQUIRED

A. Provide Whirlpool model WFG515SOES Freestanding Gas Range with Accubake Temperature Management System. Overall 47-7/8”H x 29-7/8" W x 27-7/8" D. Freestanding type. Hidden bake element. Top of oven broiler location.1 oven light; 2 wire oven racks; 5 oven rack guides. Backguard electronic touch oven control location; self -leaning cycle. Removable oven door with extra large window; Front cooktop control location; sealed burner elements; porcelain coated steel cooktop surface material; dishwasher safe cast iron grates; electronic ignition; 1 15,000 BTU front element burner, 3 multi-purpose burners, 2 grates.

ITEM NO. E5 - HOOD
BY OTHER TRADES

ITEM NO. E6 - ICE MACHINE; UNDER COUNTER
REQUIRED

A. Provide Scotsman Ice Systems model SCCP50MA-1SU with drain pump. Overall 14-7/8” W x 22” D x 33-3/8” H, with stainless steel door front kit, kick plate filler kit. 65 lb production / 24 hours, 26lb. bin storage capacity, air condenser; lighted bin; self-closing door, water quality sensor. Gourmet-type cube ice.

ITEM NO. F1 - REFRIGERATOR; BOTTOM FREEZER, 22 CU. FT.
REQUIRED

A. Provide Whirlpool model WRF535WHZ French Door Refrigerator with Internal Water Dispenser, Overall 35-5/8" w X 35-1/2" D X 70-1/8"H. 25.2 cu. ft. capacity. Energy Star certified. Interior up front controls. Controls regulate both fresh food and freezer sections; adjustable spill-proof glass shelves; 2 adjustable humidity control drawers; 1 Pantry drawer; adjustable refrigerator door bins; interior water dispenser; Pull out type freezer door; 2 wire freezer drawer baskets; automatic defrost; factory installed ice maker located in freezer; stainless steel.

ITEM NO. F2 - RESIDENTIAL GAS RANGE/DOUBLE OVEN;
REQUIRED

A. Provide Whirlpool model WGG745SOFS Freestanding Double Oven Gas Convection Range. Overall 47-1/8" H. x 29-15/16" W x 27-1/4"" D. Freestanding type. Hidden type 16,000 BTU bake element; True Convection element; incandescent oven light; 3 standard oven racks. Backguard electronic touch oven control location; adjustable self cleaning cycle; removable oven doors with extra large window, Front cooktop knob control location; Porcelain coated steel cooktop; 5 sealed burners including 1 center rear oval burner; left front element - 16,000 BTU burner power; electronic ignition; two cast iron grates.

1. Provide manufacturer approved power cord.

ITEM NO. F3 - RESIDENTIAL DISHWASHER
REQUIRED

A. Provide Whirlpool model WDF550SAFS, Energy Star certified, under counter dishwasher. Overall 24"D x 34.5" H x 23-9/16" W. ADA height and operation compliant; CEE Tier 1, Sound package to provide maximum decibel level of 54 dBA. Automatic temperature controls, front control location. Detergent and rinse aid dispenser, 2 wash arms, 2 nylon racks; full length silverware basket, built-in tall tub, water filtration. 2-4-8 hour delay options, heated dry, high temperature wash option, 5 wash cycles. Stainless steel exterior with black pocket handle, stainless steel tub.

ITEM NO. F4 - CLOTHES WASHER, 4.5 CU. FT. FRONT LOAD
REQUIRED

A. Provide Whirlpool model WFW92HEFC, front load washer with Load & Go, 12 cycles. Overall 39-3/4" H x 27" W x 33-5/16" D. Energy Star Certified. Reversible door with window. ADA height and side and front reach compliant. UL listed; CEE Tier II; advanced vibration control. Auto load size sensing; automated dispensing; detergent, fabric softener, and bleach dispensing; stainless steel drum; interior light; internal heater; maximum spin rate 1200 RPM; out of balance sensing; 5 spin speeds, 4 soil levels.

1. **Provide 6 foot stainless steel wrapped hot and cold water supply hoses with 90 degree elbows.**
2. **Provide 48" corrugated plastic discharge hose with 180 degree hook end and holding clamp.**
3. **Provide manufacturer approved power cord.**

ITEM NO. F5 - CLOTHES DRYER; 7.4 CU. FT FRONT LOAD
REQUIRED

A. Provide Whirlpool model WED92HEF Front load electric washer with Advanced Moisture Sensing, EcoBoost. Overall 39" H x 27" W x 31" D. ADA compliant. UL listed; sound package. Reversible door with window. Front panel controls, automatic temperature controls. 10 dryer cycles, 3 dryness levels, 5 drying temperatures; end of cycle signal, lint filter indicator. Stainless steel drum; interior light; moisture sensor; Quad baffles; steam hose Y connector.

ITEM NO. F6 - HOOD
BY OTHER TRADES

ITEM NO. F7 - COUNTERTOP MICROWAVE; 1.6 CU. FT.
REQUIRED

A. Provide Whirlpool model WMC30516HZ, 1200 watts, electronic touch controls w/ lock mode; overall 17.25" D x 13.0" H x 21.75" W. Sensor cooking, clock, 10 power levels, 13.5" recessed glass turntable; widow in door; stainless steel exterior wrap and powder coat interior.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The provider of food service equipment must examine roughed-in mechanical and electrical services, and installation of floors, walls, columns, and ceilings, and other conditions under which food service work is to be installed; verify dimensions of services and substrates before fabricating work. Notify coordinating trade of unsatisfactory locations and dimensions of other work and of unsatisfactory conditions for proper installation of food service equipment. Do not proceed with fabrication and installation until unsatisfactory dimensions and conditions have been corrected in manner satisfactory to installer.

B. Set each item of non-movable, non-mobile and non-portable equipment securely in place, leveled and adjusted to correct height. Adjust counter tops and other work surfaces to a level tolerance of 1/16" maximum offset, and maximum variation from level or indicated slope of 1/16" per foot. Dish tables shall slope to the dish machine, disposal, or trough for positive drainage.

C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and requirements of authorities having jurisdiction.

D. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

E. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing, unless Item specification differs. Produce airtight, watertight, vermin-proof, sanitary joints.

F. Punch List Inspection Requirements; Food Service Equipment is not ready for punch list inspection until the following have been completed for **ALL EQUIPMENT**;

1. All set in place per plan (mobile & stationary).
2. All equipment unpacked & assembled with all protective packaging, papers and films removed.
3. All sealants & sound deadening applied.
4. All plumbing, mechanical & electrical connections completed.
5. All equipment with cord / plug sets to be plugged in.
6. All operational equipment has been turned on and tested for operation.
7. All cleaned of dirt/dust/debris and fabrication markings.
8. All packing / packaging and installation fittings removed from the food service areas.
9. All equipment completed per these specifications and food service drawings.
10. Requests for a punch list inspection prior to completion of these requirements will not be honored. Punch list inspections made by the Food Facility Consultant based on false representation of completion by the provider of food service equipment or coordinating trade will be billed to the food service equipment provider for time, travel, meals and related visit expenses.

3.2 CLEANING AND PROTECTING

A. Remove all debris from equipment and site, accumulated by delivery and installation of all equipment in this Contract.

B. Restoration: After completion of installation, and completion of other major work in food service areas, remove protective coverings, if any, and clean food service equipment, internally and externally. Restore exposed and semi-exposed finishes to remove abrasions and other damages; polish exposed metal surfaces and touch-up painted surfaces. Replace work which cannot be successfully restored.

C. Final Cleaning: Clean and sanitize food service equipment and leave in condition ready for use in food service. Cover food service equipment with 4-mil polyethylene film as protective cover.

3.3 DEMONSTRATION

A. Testing: Delay start-up of food service equipment until utilities services have been tested, balanced, and adjusted for pressure, voltage, and similar considerations; and until water and steam lines have been cleaned and treated for sanitation. Before testing, lubricate each equipment item in accordance with manufacturer's recommendations. The food service equipment provider, with his own personnel or those of a service agency, shall turn on and test all functions of each item of operational equipment, **PRIOR TO THE SUBSTANTIAL COMPLETION PUNCH LIST AND OWNER DEMONSTRATION**, to assure that it is operating properly, and that controls and safety devices are functioning. Repair or replace equipment **PRIOR TO THE SUBSTANTIAL COMPLETION PUNCH LIST AND OWNER DEMONSTRATION**, which is found to be defective in its operation, including units which are below capacity or operating with excessive noise or vibration.

Instruct Owner's operating personnel in proper operation and maintenance procedures for each new item of operational food service equipment. **PRIOR TO THE SUBSTANTIAL COMPLETION PUNCH LIST AND OWNER DEMONSTRATION,** start and burn-off all equipment as necessary. Food service equipment provider shall demonstrate full operation and prepare a minimum of one food item (on cooking equipment) with each piece of operational equipment for demonstration and proper installation verification to the owner. Menu and food will be by the Owner. Refer to Division 01 Section.

END SECTION 114000
MHA Wamego CK 6/23/17

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SECTION 22 00 00 - PLUMBING

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. This Section of the Specification includes the furnishing and installation of complete drainage, water supply, plumbing fixtures and other equipment as described herein and as indicated on the Drawings.

1.2 SUBMITTALS:

A. Submit complete printed catalog and descriptive data for each major piece of equipment, clearly indicating exactly what features, options and accessories are being provided.

B. See Section 23 01 00.

1.3 SEWER AND WATER CONNECTIONS:

A. Connections to on site water, sewer and gas services shall be in accordance with the requirements of the 2012 International Plumbing Code and the respective Utility Company. Pay all associated tap and meter fees and costs.

B. Before any new sewer work is done, the Contractor shall uncover the sewer line where connection is to be made and shall determine the actual elevation. If the actual elevation of the sewer at the point of connection is such that the new drainage line cannot be installed with the required slope to the new fixtures, the matter shall be referred to the Architect as soon as possible.

PART 2 - PRODUCTS

2.1 DRAINAGE AND VENT PIPING:

A. Hub-and-Spigot Pipe: Hub-and-spigot cast-iron pipe not larger than 15-inch size shall be service weight ASTM A74, coated. All changes in pipe size of soil, waste, and drain lines shall be made with reduction fittings or reducers. Changes in direction, where space permits, shall be made with long sweep bends, Y-fittings and 1/8 or 1/16-bends, or combination Y and 1/8-bends. Sanitary tee branches and 1/4-bends may be used for connections of branch lines to fixtures and on vertical runs of pipe. Hub-and-spigot cast-iron pipe larger than 15-inch size shall be Type II or III; Grade C, cast-iron pressure pipe.

1. Gasketed Joints: Molded neoprene elastic compression type gaskets. Gaskets shall conform to ASTM C 564, and pipe, fittings, and gaskets shall bear the symbol of the Cast Iron Soil Pipe Institute. Pipe and fittings shall be manufactured with the spigot ends plain

and beveled, and the bells shall be modified to receive the gaskets. Service weight soil pipe and fittings shall be joined with service weight gaskets. Service weight gaskets shall be clearly designated and identified. A lubricant shall be used in making the joints. When the joint is completed, a tight seal shall be formed between the external face of the pipe and the internal face of the bell. Gaskets shall be capable of making and maintaining a tight seal with a deflection not to exceed 5 degrees. Deflection of pipe will not be allowed to avoid the use of a fitting. Joints shall be assembled by the tools and as recommended by the pipe, fittings, and gasket manufacturers.

B. "N0-Hub" Cast-Iron Pipe: "No-Hub" cast-iron soil pipe and fittings shall conform to Cast Iron Soil Pipe Institute Specification 301 and ASTM A-888. Pipe, fittings, and couplings shall bear the symbol of the Cast Iron Soil Pipe Institute. "No-Hub" piping systems shall be installed in accordance with the manufacturer's recommendations.

C. Threaded Steel Pipe: Threaded steel pipe shall be galvanized, Schedule 40 conforming to ASTM A 53.

D. Threaded Copper Nickel Steel Pipe: Threaded copper nickel steel pipe shall conform to ASTM A 714, Grade V, galvanized.

E. Threaded Cast Iron Pipe: Threaded cast iron pipe shall comply with ASTM A-74.

1. Fittings on threaded ferrous soil, waste, and drain piping, including storm drainage piping and couplings on pipes 6- inches and smaller, shall comply with ANSI B 16.12. Short tee branches and short turn elbows may, except for wall hung water closets, be used for connections of branch lines to fixture and on vertical runs of pipe; long turn fittings shall be used in all other locations where space permits. Fittings may be galvanized or black, coated or uncoated. Couplings on pipes 8-inches and larger shall be standard weight steel, zinc-coated (galvanized) and need not be recessed; steel couplings shall not be used on piping 6- inches and smaller.
2. Fittings on threaded ferrous vent pipes shall comply with ANSI B 16.3, B16.4, or B 16.12. Couplings shall be as specified above for soil, waste, and drain piping.

F. Copper Tubing: Copper tubings shall be Type M, in accordance with ASTM B-88, or Type DWV in accordance with ASTM B 306. Ends of tubing shall be cut square and shall be reamed before being made up. Tubing ends shall enter the full depth of the fitting recesses without binding.

1. Fittings for copper tubing shall be solder type, recessed drainage pattern, of wrought copper or cast brass. Recesses shall be smooth and correctly sized to provide proper clearance over the tubing. Solder shall be composition 95/5 tin-antimony or Brigit. Flux shall be noncorrosive. Tubing ends and fitting recesses shall be thoroughly cleaned. Solder shall penetrate fully and shall fill the joint completely.

G. Plastic Pipe and Fittings: Schedule 40 PVC, ASTM D-1784 with solvent welded joints.

2.2 UNDERGROUND WATER PIPING:

A. Underground domestic water piping beyond five feet outside the building shall be as specified by the Civil Engineer.

B. Underground water piping beneath the building to a point five feet outside the building shall be one of the following:

1. Cross-linked polyethylene (PEX).

a. Material Standard: Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third party agency.

1) Standard grade hydrostatic design and pressure ratings from Plastic Pipe Institute.
2) Minimum Bend Radius (cold bending): No less than 6 times the outside diameter. Use a bend support as supplied by the PEX tubing manufacturer for tubing with a bend radius less than stated.
3) Nominal Inside Diameter: Provide tubing with nominal inside diameter, in accordance with ASTM F876.

b. Fittings:

1) Joints below grade shall be avoided if possible.
2) Fittings shall be of a type approved by the piping manufacturer for the application, and shall be supplied by piping manufacturer.
3) Material: Fittings shall be suitable for direct burial in earth, and shall be manufactured from one of the following –
4) Same material as piping.
5) Pollyalloy (ASTM 2359).
6) Bronze (w/ stainless steel sleeve) (ASTM 877).
7) Dezincified brass (ASTM 1807).
8) Material Standard: Comply with ASTM F1960.

c. Accessories

1) Bend supports designed for maintaining tight radius bends shall be supplied by the PEX tubing manufacturer.
2) Tools required to install the piping fittings shall be supplied by the PEX tubing manufacturer.
3) The tubing manufacturer will provide clips and/or PEX rails for supporting tubing runs.

d. Warranty:

1) Warranty Period for PEX piping and fitting system shall be 25-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion.

e. Acceptable Manufacturers – Mr. Pex, Uponor, Viega.

2. Copper tubing, Type K, soft drawn, ASTM B-88.

a. Joints below grade shall be avoided if possible.
b. Where necessary, joints below grade shall utilize fittings of the recessed solder-joint type of either wrought copper or cast brass. Solder shall be silver solder

having a melting point of not less than 1120°F. Adapters for connection to threaded valves, fittings, meters and other equipment shall be cast brass. Recesses shall be smooth and correctly sized to provide proper clearance over the tubing.

2.3 ABOVEGROUND WATER PIPING:

A. Aboveground domestic water piping 3-inches in size and smaller, shall be copper tubing, Type L, hard drawn, ASTM B-88. Fittings shall be one of the following:

1. Recessed solder- joint type of either wrought copper or cast brass. Adapters for connection to threaded valves, fittings, meters and other equipment shall be cast brass. Recesses shall be smooth and correctly sized to provide proper clearance over the tubing. Solder shall be composition 95/5 tin-antimony or Brigit. Flux shall be noncorrosive. The solder shall contain no lead.
2. Mechanical grooved joint pipe couplings may be used for connecting equipment to the piping system, headers, and distribution piping in lieu of soldered tube or fitting connections for water piping with NSF-61 rated temperatures to +180°F. System shall meet the low lead requirements of NSF-372.

    a. Coupling housing clamps shall consist of two ductile iron castings complying with ASTM A-536, cast with offsetting angle-pattern bolt pads. Housing clamps shall hold in place an elastomer water sealing gasket of a FlushSeal® pressure responsive design. Clamps and gaskets shall be manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.)

        1) Victaulic Style 607H ‘Quick-Vic’ installation ready coupling, for direct stab installation without field disassembly.

    b. Fittings shall be manufactured to copper-tube dimensions, ASME B16.22 or ASME B16.18 Victaulic Copper-Connection.
    c. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components. For use with copper-tube dimensioned grooved ends. Victaulic Style 641.
3. Victaulic Installation-Ready™ fittings for grooved end copper tubing shall be manufactured to copper-tube dimensions. Fittings shall be ductile iron conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready™ ends, complete with PVDF (Poly Vinylidene Fluoride) and Grade “EHP” EPDM-HP [Grade ‘T’ Nitrile] gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be rated to 300 psi (2065 kPa) with Type K or L Copper Tubing.
4. Viega ProPress Fitting: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have SC (Smart Connect) feature design (leakage path). Smart Connect ™ (SC Feature) In ProPress ½” to 4" dimensions the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection (when testing from ½ to 85 psi). The function of this feature is to provide the installer

quick and easy identification of connections which have not been pressed prior to putting the system into operation.

B. At contractor's option, branch piping serving toilet rooms and downstream of toilet room isolation valves, and piping serving individual fixtures may be PEX piping as specified for underground water piping.

2.4 UNDERGROUND SOIL, WASTE, VENT AND DRAIN PIPING:

A. Underground soil, waste, vent and storm drainage piping shall be as follows (unless otherwise indicated on Drawings):

1. Underground sanitary and storm drain lines shall be hub- and-spigot cast-iron, or plastic pipe.

2.5 ABOVEGROUND SOIL, WASTE, VENT AND DRAIN PIPING (includes condensate drain piping):

A. Aboveground soil, waste, vent and storm drainage piping:

1. Where exposed in rooms or where located in return air plenums, piping may be hub- and-spigot cast iron, or "No-Hub" cast iron, threaded galvanized steel, threaded copper nickel steel, threaded cast iron, copper tubing, or CPVC pipe. **PVC piping shall not be used where exposed or located in return air plenums.**
2. Where installed inside walls or above ceilings that are not return air plenums, piping may be hub- and-spigot cast iron, or "No-Hub" cast iron, threaded galvanized steel, threaded copper nickel steel, threaded cast iron, copper tubing, PVC or CPVC pipe.
3. Exposed waste piping and fittings in toilet rooms, and in finished areas, shall be chromium plated brass. Pipe shall be red brass, standard weight, iron pipe size and thickness, ASTM B-43, and fittings shall be threaded cast-brass of the recessed drainage pattern. Chromium plated piping shall be carefully measured and cut so that no more than one full turn of thread shall be exposed beyond any fittings. Joints between brass and ferrous pipes shall be threaded.

2.6 TRAPS:

A. Provide deep seal traps on all floor drains.

2.7 CLEANOUTS AND FERRULES:

A. Cleanouts shall be installed as shown on Drawings and where required by the building code.

B. Cleanout plugs for threaded fittings shall be in accordance with Table 52 of CS 188. Except for test openings, where size must be sufficient to admit test plug, bushings will be permitted on pipes 5-inches and larger to reduce plug size to 4-inches; cleanout plugs for piping 4-inches and smaller shall be the same size as the pipe.

C. Cleanout plugs for hub-and-spigot fittings shall be screwed into ferrules caulked into the fitting. Ferrules and plugs shall be in accordance with Table 54 of CS 188.

D. Cleanout plugs on copper drainage lines shall be installed in solder-joint fittings having threaded openings provided for the cleanout, or in solder-joint fittings with threaded adapters.

E. Acceptable Manufacturer - Josam, Smith, Zurn, Wade.

2.8 FLASHING:

A. Openings in roof for waste vent pipes shall be provided with flexible rubber boots clamped to vent pipe and flashed into roofing. Products and installation shall be watertight and shall be approved by the National Roofing Contractor's Association.

2.9 DIELECTRIC ISOLATORS:

A. Provide a dielectric isolator at all points of connection between ferrous and nonferrous piping. Isolators shall be made of Teflon or nylon made up in the form of screwed type unions or insulating gaskets and bolt sleeves and washers for standard flanged connection.

B. Connections may be made with Schedule 80 CPVC nipples, nylon or Teflon bushings selected for the temperatures and pressures of the system.

2.10 VALVES:

A. All valves shall be designed for 125 psi minimum water working pressure, but in no case less than 150% of the system operating pressure, whichever is greater.

B. Provide valves with extended necks in insulated piping.

C. All valves installed in potable systems shall be lead-free in accordance with Federal Government S.3874.

D. Ball Valves:

1. For size 4- inch and smaller shall be 2 piece, full port brass ball valves with RPTFE seats and packing, blow out proof stem, and sweated or threaded ends.

    a. Equivalent to Apollo 77FLF.

E. Check Valves:

1. Check valves 2-inch in size and smaller shall be soldered bronze body, horizontal swing check type with regrindable seat and Buna-N disc.

    a. Equivalent to Nibco S-413.

2. Check valves 2 1/2-inch in size and larger shall be flanged, cast iron, spring actuated, , horizontal swing check type with stainless steel spring, aluminum bronze bushing, Buna-N bonded to bronze seat, and bronze disc.

   a. Equivalent to Nibco F-910-B-LF.

F. Butterfly Valves:
1. 2 through 6-inch, 300 psi (2065 kPa) maximum pressure rating, with copper tubing sized grooved ends. Cast brass body to UNS C87850. Aluminum bronze disc to UNS C95500, with pressure responsive elastomer seat. Stem shall be offset from the disc centerline to provide complete 360-degree circumferential seating. Certified to the low lead requirements of NSF-372. Victaulic Series 608N.

G. Acceptable Manufacturers – Apollo, DeZurik, Milwaukee, Nibco, Victaulic, Watts.

H. Automatic Balancing Valves:

1. Automatic flow control valves shall be factory set to a rated flow, and shall automatically control the flow to within ±10% of the rated value over a 40 to 1 differential pressure, operating range, (2 to 80 psid). Valves shall have the capabilities and pressure ratings as indicated and conform to this specification.
2. Automatic balance assembly shall include one or more precision sculptured brass or polyphenylsulfone orifi with an elastomeric diaphragm. Each automatic balancing valve shall automatically control the flow rate to within ±10% of its rated flow, over a temperature range of 32 to 225°F, and a pressure differential range of 2 to 80 psid.
3. Inline copper sweat valves 1/2, 3/4, 1, & 1 1/4 inch shall consist of a wrought copper (ASTM B88-83a) housing. Valve bodies shall be suitable for 522 psig working pressure rating per ASME B31.9 Building Services Piping. Flow rates from 0.5 to 25 gpm shall have a differential pressure operating range of 2 to 80 psid.
4. Equivalent to Hays Model 2511, or Victaulic ICSS TA Series 76X.

2.11 WALL HYDRANTS:

A. Wall hydrants shall be cast bronze, chrome plated nonfreeze type with 3/4-inch inlet and 1-inch copper casing of sufficient length to extend through walls as required to place valve inside the building. Valve rod and seat washer shall be removable through the face of the hydrant. Hydrants shall be furnished complete with adjustment locknuts, union elbows, detachable T-handles, and integral vacuum breaker.

B. Acceptable Manufacturers - Josam, MiFab, Prier, Smith, Wade, Watts, Woodford, Zurn.

2.12 GAS PIPING:

A. Underground distribution piping shall be polyethylene piping conforming to applicable State and Federal Standards. The installation shall be completed by personnel meeting the requirements of applicable State and Federal Standards. Risers to above grade shall be anodeless. Joints shall be fusion butt welded. Provide tracer wire.

B. Aboveground distribution piping 2-inches and smaller shall be Schedule 40 black steel using malleable iron threaded fittings, wrought steel butt welding fittings or pressed fittings.

1. Pressed fittings shall be Viega MegaPress Gas Press Fittings. MegaPress Fittings: ½-inch through 2-inch shall conform to ASME B31.1, ASME B31.3, or ASME B31.9 MegaPress fittings with zinc and nickel coating for use with IPS carbon steel pipe conforming to ASTM A53, ASTM A106, ASTM A135, or ASTM A795. MegaPress fittings shall have an HNBR sealing element, 420 stainless steel grip ring, separator ring, and an un-pressed fitting leak identification feature. Sealing elements shall be verified for the intended use. Installation must be in accordance to manufactuer's instructions and specifications.

C. Aboveground distribution piping 2 1/2-inches and larger, and concealed piping of any size shall be Schedule 40 black steel with wrought steel butt welding fittings, or pressed fittings as specified above.

D. Valves:

1. For sizes 1-inch and smaller, provide ball valves, 125 psig WOG.
2. For sizes larger than 1-inch, provide gas cocks, 125 psi WOG, bronze straight way cocks, flat or square head, threaded ends for 2-inches and smaller, flanged ends for 2 1/2-inches and larger.

2.13 GAS PRESSURE REGULATORS:

A. Regulators shall be single stage, steel jacketed, corrosion resistant, with vent line extended to atmosphere, threaded ends for 2-inches and smaller, flanged ends for 2 1/2-inches and larger.

B. Acceptable Manufacturers - Fischer, Maxitrol.

2.14 FIXTURE SUPPLY PIPING SUPPORTS:

A. Support and position fixture rough-in piping in plumbing chases, shafts, fixture walls or batteries, at each fixture with metal strut framing system or angle iron supports and U- bolt clamps or high impact polystyrene or ABS anchoring channels designed for the purpose. Anchors shall effect positive electrolytic isolation, noise dampening, solid support, and rough-in positioning. See Section 23 20 00 for additional requirements.

B. Acceptable Manufacturers - Sumner, Pipefix, Channel.

2.15 BACK-TO-BACK FIXTURE MANIFOLD:

A. Wherever fixtures utilizing both hot and cold water are installed back-to-back on a partition, the hot water shall be on the left and the cold water shall be on the right on both sides of the partition. Cast bronze manifold fittings designed for the purpose, and to offset around stack may be used.

B. Acceptable Manufacturers - Precision Plumbing Products "BAC 2 BAC", or approved equal.

2.16 SHOCK ABSORBER:

A. Shock absorbers shall be factory fabricated stainless steel casing and bellows with working pressure of 250 psi, bellows precharged with nitrogen. Construction shall be in accordance with Plumbing and Drainage Institute Standard PDI-WH201, ANSI A-11, 2.26.1, and ASSE 1010.

B. Acceptable Manufacturers - Josam, MiFab, Smith, Wade, Watts, Zurn.

2.17 PLUMBING FIXTURES, GENERAL:

A. Provide plumbing fixtures scheduled, at locations and mounting heights indicated on architectural drawings.

B. Provide fixture, trim and equipment specified or of similar quality, design, capacity, appearance and function by acceptable manufacturer listed.

C. Provide required trim for each fixture including faucets, stops, drains, tail pieces, traps and escutcheons.

D. Fixtures fitted to walls shall have backs ground square and true. Caulk juncture of fixture with wall or floor as directed by the Architect.

E. Exposed Pipe - Exposed flush, waste and supply pipes at fixtures shall be chromium plated brass pipe, iron pipe size.

F. Vandalproofing - Provide vandalproof fittings for all fixtures.

G. Acceptable Manufacturers -

1. Fixtures - American Standard, Crane, Gerber, Kohler, Sloan, Toto, Zurn.
2. Stainless Steel Sinks (self-rimming) - Elkay, Just, Kohler, Kindred.
3. Faucets and Drains - American Standard, Bradley, Chicago, Delta, Eljer, Elkay, Gerber, Kohler, Powers, Sloan, Speakman, Symmons, Zurn.
4. Supplies, Stops and Traps - Central, Crane, Dearborn, Eljer, McGuire.
5. Closet Seats - Church, Beneke, Olsonite, Sperzel.
6. Carriers - Josam, MiFab, Smith, Wade, Watts, Zurn.
7. Service Sinks - Florestone, Fiat, Stern-Williams.
8. Floor Drains - Josam, MiFab, Smith, Wade, Watts, Zurn.

2.18 PIPE HANGERS AND SUPPORTS:

A. See Section 23 01 00.

2.19 WATER HEATER - POWER DIRECT-VENT, GAS FIRED, STORAGE TYPE:

A. Provide AGA approved storage water heater as scheduled, with welded steel tank, polyurethane closed cell insulation, protective sheet metal jacket with baked enamel finish, fully submerged glass-lined condensing heat exchanger, controls, non-sacrificial powered anode rod(s) and

temperature and pressure relief valve. Provide water heater with ASME rating when scheduled and for all models with an input rating of 200,000 BTUH or greater.

B. The heater shall be suitable for sealed combustion direct vertical or sidewall venting using PVC air intake and exhaust pipe for a total of 120 equivalent feet of intake pipe, and 120 equivalent feet of vent pipe.

C. The tank shall be fully glass or phenolic epoxy plastic lined after assembly and welding of tank. The tank shall be approved for a working pressure of 160 psi minimum. A hand hole cleanout and a drain valve shall be located near the bottom of the tank. The tank assembly shall be covered by a three year limited warranty against failure due to corrosion, metal fatigue or overheating caused by the buildup of scale, film or sediment.

D. The heat exchanger shall be fully submerged, condensing, spiral shaped, and glass-lined on both water and vent sides to protect against corrosive flue gasses and condensate inside the coil.

E. The heater shall operate at a minimum of 96% thermal efficiency when tested to ANSI Z21.10.3 "Gas Water Heaters". The heaters standby losses shall satisfy ASHRAE 90.1 standards.

F. A microprocessor shall control all heater functions including ignition and temperature regulation. Precise temperature control shall be adjustable from 90 to 180 degrees F. A LCD display shall provide detailed operational and diagnostic information in plain English.

G. The heater shall be completely packaged, requiring only field connection for gas, electrical power, plumbing, and combustion air intake and venting. Provide a thermal expansion tank for the hot water system. Additionally, provide all accessories required to complete water heater installation as scheduled, as indicated on Drawings and as recommended by equipment manufacturer.

H. Provide a thermometer at the outlet of each water heater.

I. Acceptable Manufacturers - A.O. Smith, Lochinvar, PVI, State.

2.20 TEMPERATURE AND PRESSURE RELIEF VALVES:

A. Provide combination temperature and pressure relief valves on each domestic water heater and fired pressure vessel. Valves shall be constructed and rated in accordance with ASME standards, with cast iron bodies, shall be of the diaphragm type, with stainless steel spring, field adjustable, set to relieve above the operating pressure or temperature, but lower than the design pressure of the vessel. Pipe blowoff line full size to 6" above finished floor.

B. Acceptable Manufacturers - Amtrol, Bell & Gossett, Taco, Watts.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION:

A. Do not route piping above electrical distribution equipment, per National Electric Code.

3.2 SOIL, WASTE AND VENT SYSTEMS:

A. Pitch lines at 1/8-inch per foot minimum and 1/4-inch per foot where possible.

B. Below Grade - Install immediately after excavation, lay pipe so that entire length bears on firm soil, excavate for hubs, do not backfill until installation has been observed.

C. Above Grade - Install in structure as high as possible. Independently support each length of cast iron. Support steel pipe according to hanger schedule. Support vertical lines at each floor, both horizontally and laterally.

D. Joints and Fittings for CPVC and PVC plastic piping shall be prepared and solvent welded according to manufacturer's recommendations.

E. Vents - Slope up to high point. Support each length of vent pipe independently within structure.

F. Sanitary Waste Cleanouts - Install cleanouts where required by code and as shown on Drawings. Set floor cleanout covers flush with adjacent finished surface.

G. Floor Drains, Waste Receptors - Install as shown and connect to cast-iron, deep seal "P" trap. Where a water proof membrane is used, anchor membrane to flange with clamping collar and rustproof bolts.

H. Drain Lines - Install drain lines from air conditioning equipment, tanks and other items of equipment requiring regular drainage, to waste receptors. Terminate above receptors with elbow turned down when piping is run horizontal to receptor.

I. Plumbing Fixtures - Rough-in and install plumbing fixtures at height as recommended by the manufacturer unless otherwise indicated on architectural drawings. Caulk perimeter of wall or floor mounted fixture where it meets wall or floor. caulking shall be of type and color as selected by Architect.

3.3 STORM WATER SYSTEMS:

A. Pitch lines at 1/8-inch per foot minimum and 1/4-inch per foot where possible.

B. Below Grade - Install immediately after excavation, lay pipe so that entire length bears on firm soil, excavate for hubs, do not backfill until installation has been observed.

C. Above Grade - Install in structure as high as possible. Independently support each length of cast iron. Support steel pipe according to hanger schedule. Support vertical lines at each floor, both horizontally and laterally.

D. Drains-

1. Set roof drains, and other storm related drains.
2. Connect to piping systems - use rigid connections.
3. Install roof drains with lead flashing and set covers flush with adjacent finished surface.

E. Storm Cleanouts - Install where indicated on Drawings and where required by code.

3.4 DOMESTIC WATER SYSTEMS:

A. Below Grade - Install immediately after excavation, do not backfill until installation has been observed, and lay pipe so that entire length bears of firm soil.

1. Site Verification of Conditions:

a. Verify that site conditions are acceptable for installation of the PEX potable water system.

2. PEX Piping Installation:

a. Do not proceed with installation of the PEX potable water system until unacceptable conditions are corrected.
b. Install PEX tubing in accordance with the tubing manufacturer's recommendations and as indicated in the 2006 Plastic Pipe Institute/Plastic Pipe and Fitting Association/NAHB/PATH Design Guide.
c. Joints below grade shall be limited to those required for tees and connection to valves at connections to buildings.
d. Minimum horizontal supports are to be installed not less than 32 inches between hangers in accordance with model plumbing codes and the installation handbook.
e. Do not expose PEX tubing to direct sunlight for more than 30 days.
f. Ensure no glues, solvents, sealants or chemicals come in contact with the tubing without prior permission from the tubing manufacturer.
g. Protect PEX tubing with sleeves where abrasion may occur.
h. Use tubing manufacturer supplied bend supports where bends are less than six times the outside pipe diameter.
i. Pressurize tubing with air in accordance with applicable codes or in the absence of applicable codes to a pressure of 25 psi (173 kPa) above normal working pressure of the system.
j. Comply with safety precautions when pressure testing, including use of compressed air, where applicable. Do not use water to pressurize the system if ambient air temperature has the possibility of dropping below 32 degrees F (0 degrees C).
k. Field Quality Control:

1) Manufacturer’s Field Services: Provide manufacturer’s field service consisting of product use recommendations and one site visit for inspection of product installation in accordance with manufacturer’s instructions.

B. Above Grade - Run level as high as possible in building structure, install hangers per schedule, allow for expansion and contraction, and anchor where required. Separate hot and cold pipes, with 6-inch minimum clear space between piping. Install 3/4-inch hose end drain valve at low points. Install ball valve at each plumbing fixture or group of fixtures, and at each point of connection to equipment. Allow access to equipment, for removal and servicing of pumps or equipment without draining system.

1. PEX Piping Installation:

a. Install PEX tubing in accordance with the tubing manufacturer's recommendations and as indicated in the 2006 Plastic Pipe Institute/Plastic Pipe and Fitting Association/NAHB/PATH Design Guide.
b. Exposed PEX piping shall be neatly installed plumb and parallel to building surfaces, and supported to eliminate sags and deflections.

2. Copper Piping Installation:

a. For slabs on grade, copper pipe shall be separated from sand fill beneath poured concrete by a minimum of 6 inches of soil backfill.
b. Isolate copper pipe from concrete at all locations where piping penetrates concrete or masonry construction.

C. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

D. Viega ProPress connections: Copper press fitting joints shall be made in accordance with the manufacturer's installation instructions. Pipe shall be approved by manufacturer for use with fittings. Piping shall be square cut, properly deburred, and cleaned. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

E. Connections to equipment:

1. Connect to each plumbing fixture.
2. Connect to each hydrant.
3. Provide valved connections to each piece of kitchen equipment or owner-provided equipment requiring water connection. Provide pressure regulators, pressure reducing valves, vacuum breakers, shock arrestors and other accessories as required for equipment supplied.
4. Provide unions or flanged connections at each piece of equipment connected.
5. Install supply connections to fixtures through wall as high under fixtures as possible.

3.5 WATER HEATER INSPECTION CERTIFICATE:

A. When required by the Kansas Boiler Safety Act for the storage capacity and/or firing rate of the installed water heater, the Contractor shall be responsible for obtaining an inspection and acceptance certificate from the State Boiler Inspector. The Contractor shall schedule and pay for the inspection, and shall post the certificate(s) in the room containing the water heater.

3.6 SHOCK ABSORBERS:

A. Install in accessible locations, see drawings. Provide access panels where required.

3.7 DISINFECTION OF WATER SYSTEMS:

A. General - Disinfect all domestic water systems. Disinfection shall not start until water systems are complete, connections made, and system is flushed out. Upon completion of disinfection, submit certificate and certified bacteriological test report for approval.

B. Follow the method prescribed by the local Health Department, Building Code Department or water purveyor. In the absence of a prescribed method, follow the procedure outlined in either AWWA C651 or AWWA C652.

3.8 GAS PIPING SYSTEM:

A. Above Grade - Run level and as high as possible. Install hangers per schedule. Allow for expansion and contraction. Anchor where required. Install Schedule 10 carbon steel welded gas tight pipe casing around piping in concealed vented areas. Pipe casings to be vented to atmosphere. Pipe casings not required in exposed areas.

B. Below Grade - Installation shall meet the requirements of applicable State and Federal Standards.

C. Above Roof - Support piping at no more than 8 feet on center, with manufactured pipe supports: Miro Industries Model 3-R or approved equivalent. The pipe supports shall be a roller- bearing type designed to support piping or conduit, and to absorb thermal expansion and contraction of piping or conduit thus preventing damage to roof membrane. The pipe or conduit shall rest on a polycarbonate resin roller and a glass-filled nylon rod situated in a polycarbonate resin seat.

D. Connections to equipment - Connect at each appliance or gas using device and provide gas cock unions, and dirt leg.

3.9 TESTING:

A. Systems shall be tested in accordance with the 2012 International Plumbing Code prior to insulating, covering or concealing this work.

B. Plug or cap lines for testing and disconnect equipment and devices which may be damaged by excessive test pressures.

C. Before final connections are made to site sewer and connection of fixtures, all underground drainage piping shall be hydrostatically tested. All openings shall be capped or plugged and the system filled with water to the top of a vertical section of pipe 10 feet high, temporarily connected to the highest point of the underground system. The water shall be allowed to stand in the system for at least 30 minutes prior to inspection. If the water level remains constant and no leaks are found during the period of inspection, the water shall be drained form the system. Final connections shall then be made to the site sewer and the trenches backfilled.

D. Before any fixtures are connected, all sanitary drain and vent systems, and storm drainage systems above ground, shall be hydrostatically tested. All opening shall be capped or plugged and the systems filled with water. The water shall be allowed to stand in the systems for at least 30 minutes prior to inspection. If the water level remains constant and no leaks are found during the period of inspection, the water shall be drawn off and fixtures, etc., connected. No parts of a system shall be tested with less than 10-foot head of water. No parts of a system using cast iron bell-and-spigot pipe shall be tested with more that a 40-foot head or water, and no parts of a system using screwed piping shall be tested with more than 200-foot head of water. The Contractor shall be responsible for determining the amount of piping he wishes to test at one time, but the above conditions shall not be exceeded.

E. Before final connections are made to a water supply system, all underground water piping shall be hydrostatically tested and proven tight at a pressure of not less than 100 psi or 50 psi in excess of the working pressure, whichever is greater, at the lowest point in the system. The pressure shall be maintained for at least 1 hour for inspection, the water shall be drained from the system. Final connections shall then be made to the water supply system, and the trenches backfilled.

F. Before any fixtures or equipment are connected, all domestic water and compressed air systems connected thereto above ground shall be hydrostatically tested and proven tight at a pressure of not less than 100 psi or 50 psi in excess of the working pressure, whichever is greater, at the lowest point in the system. The pressure shall be maintained for at least 2 hours for inspection. If the pressure remains constant and no leaks are found during the period of inspection, the water shall be drained from the systems and final connections shall then be made to the fixtures, etc.

G. All tests shall be made when there is no danger of freezing, prior to enclosure of any parts of the systems by furrings, suspended ceilings, etc.

H. Test to demonstrate the capacities and general operating characteristics of all equipment, such as water heating outfits, pumps, water coolers, etc., shall be made under the direction of the Architect at the time of final inspection and under conditions imposed by him. Water heaters having steam or water coils shall be tested with the main heating system in operation.

I. Gas piping shall be tested in accordance with the requirements of the local building code and the 2012 International Fuel Gas Code.

J. All tests shall be made in the presence of and results approved by the Architect.

K. Should any leaks, flaws, or defective materials or equipment be found during the testing operations, such leaks or flaws shall be corrected, and defective materials and equipment replaced. All defective joints shall be remade, and calking or threaded joints will not be acceptable. After corrections have been made, tests shall be repeated until all systems are proven tight and satisfactory. All corrections and retests shall be made at Contractor's expense.

3.10 CLEANING:

A. See Section 23 01 00.

3.11 COMPLETION:

A. Complete each piping system in its entirety. Properly support the system, clean the interior surfaces of the pipe by flushing, and disinfecting domestic water piping as specified. Leave systems filled and free from air, and ready for operation and testing.

END OF SECTION 22 00 00

SECTION 23 01 00 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

A. Work covered by this section of these specifications will be accomplished in accordance with the respective drawings, information, or instructions to bidders, general requirements, and the supplementary and general conditions of these specifications. Supplementary conditions, special conditions, addenda, or directive which may be issued by the Engineer shall be complied with.

B. Bidders shall determine the contents of a complete set of drawings and specifications and be aware that they may be bidding from a partial set of drawings, applicable only to the various separate contracts, sub-contracts, or trades as may be issued for bidding purposes only. The contract documents are combined Architectural, Structural, Plumbing, Heating, Ventilating, and Air Conditioning and Electrical Drawings and Specifications. Drawings and Specifications are on file in the Engineer's office and each Bidder shall thoroughly acquaint himself with the details of the complete set of drawings and specifications before submitting his bid. Drawings and specifications form a part of the contract documents for each separate contract and shall be considered as bound therewith in the event partial sets of plans and specifications are issued for bidding only. The submission of bids shall be deemed evidence of the review and examination of drawings, specifications, and addenda issued for this project as no allowance will be made because of the Contractor's unfamiliarity with any portion of the complete set of documents.

C. Connect new work to existing work in neat and approved manner. Restore existing work disturbed to original condition.

D. Existing remaining systems shall be left in perfect working order upon completion of all new work.

E. Any equipment which is removed and not reinstalled shall be delivered on site to the Owner, or removed by the Contractor, as directed by the Owner.

1.2 MECHANICAL CONTRACTOR QUALIFICATIONS:

A. Mechanical Contractor (as a company) and his job superintendent for their portion of the work shall have at least three years of satisfactory experience in completion of projects of comparable size and complexity. Evidence of this experience will be required before approval of the Engineer as being acceptable for their portion of the work.

1.3 SCHEDULE:

A. The schedule and sequence of work must be carefully coordinated with the Owner, to ensure that all work performed within the existing buildings will result in a minimal amount of noise, dust and disruption to the activities in the existing buildings.

B. All interruptions of existing services must be coordinated with the Owner, to minimize inconvenience and disruption to the activities in the existing buildings. All interrupted services shall be restored as quickly as possible. All interrupted systems shall be thoroughly cleaned and tested prior to being placed back into operation.

1.4 SCOPE:

A. The work included under this specification consists of the furnishing of all labor, materials, tools, transportation, services, etc., which are applicable and necessary to complete the installation of the systems specified in these specifications, as illustrated on the accompanying drawings, or as directed by the Engineer.

B. In general, the various lines and ducts to be installed by the various trades under this specification shall be run as indicated, as specified herein, as required by particular conditions at the site, and as required to conform to the generally accepted standards so as to complete the work in a neat, quiet, and satisfactorily workable manner. Run work parallel or perpendicular to the lines of the building unless otherwise noted.

C. The construction details of the building are illustrated on the Drawings. Each Contractor shall thoroughly acquaint himself with the details before submitting his bid as no allowance will be made because of the Contractor's unfamiliarity with these details. Place inserts to accommodate the ultimate installation of the pipe hangers in the forms before construction. Concealed lines shall be installed as required by the pace of the general construction to precede that general construction.

1.5 INSPECTION OF SITE:

A. Contractor shall visit the site, verify existing items shown on plans or specified, and familiarize himself with the working conditions, hazards, existing grades, actual formations, soil conditions, and local requirements involved, and submission of bids shall be deemed evidence of such visit. Proposals shall take these existing conditions into consideration and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility.

1.6 UTILITIES, LOCATIONS AND ELEVATIONS:

A. Locations and elevations of the various utilities included within the scope of this work have been obtained from Record Drawings and other substantially reliable sources and are offered separately from the Contract Documents as a general guide only, without guarantee as to accuracy. Contractor shall examine the site, availability of utilities as to their relation to the work; the submission of bids shall be deemed evidence thereof.

1.7 CODES AND STANDARDS:

A. Workmanship, material and equipment shall be in accordance with Specifications and drawings and in some instances the requirements exceed those required by codes and standards. Where not exceeded, the codes and standards shall be considered as absolute minimum requirements.

1.8 MATERIALS AND WORKMANSHIP:

A. Materials unless otherwise specified shall be new, free from any defects, and of the best quality of the respective kinds. Like materials used shall be of the same manufacture, model, and quality unless otherwise specified.

B. Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, adjusted, and conditioned as recommended by the manufacturers, or as indicated in their published literature, unless specifically herein specified to the contrary.

C. Work under this contract shall be performed by competent workmen and executed in a neat and workmanlike manner providing a thorough and complete installation. Work shall be properly protected during construction, including the shielding of soft or fragile materials, and the temporary plugging of open lines during construction. At completion, the installation shall be thoroughly cleaned and tools, equipment, obstructions, or debris present as a result of this contract shall be removed from the premises.

1.9 COOPERATION:

A. Work under these specifications shall be accomplished in conjunction with other trades on this project in a manner which will allow each trade adequate time at the proper stage of construction to fulfill his work.

B. Maintaining contact and being familiar with the progress of the general construction and timely installation shall be the responsibility of this trade to expedite this contract and avoid unnecessary delays in the progress of other trades.

C. Should any question arise between trades as to the placing of lines, ducts, conduits, fixtures, or equipment, or should it appear desirable to remove any general construction which would affect the appearance or strength of the structure, reference shall be made to the Engineer for instructions.

1.10 DRAWINGS AND SPECIFICATIONS:

A. The drawings show diagrammatically the locations of the various lines, ducts, conduits, fixtures, and equipment, and the method of connecting and controlling them. It is not intended to show every connection in detail and fittings required for a complete system. The systems shall include, but are not limited to, the items shown on the drawings. Exact locations of these items shall be determined by reference to the general plans and measurements at the building, and in cooperation with other trades and, in all cases, shall be subject to the approval of the Engineer. The Engineer reserves the right to make any reasonable change in the location of any part of this work without additional cost to the Owner.

B. Should any deviations from the contract documents be deemed necessary by the Contractor, the shop drawings, descriptions, and the reason for the proposed changes shall be submitted to the Engineer for approval.

C. Exceptions and inconsistencies in plans and specifications shall be brought to the Engineer's attention before bids are submitted; otherwise, the Contractor shall be responsible for the cost of any changes and additions that may be necessary to accommodate his particular apparatus.

D. Contractor shall lay out his work maintaining lines, grades, and dimensions according to these drawings with due consideration for other trades and verify dimensions at the site prior to any fabrication or installation; and should any conflict develop or installation be impractical, the Engineer shall be notified before any installation or fabrication and the existing conditions shall be investigated and proper changes effected without any additional cost.

E. Manufactured equipment shown, arrangement of parts, openings in floors, roof or walls are sized for a particular manufacturer's equipment. The Contractor shall verify exact sizes and arrangements required by equipment and in submitting his equipment for approval he certifies that the equipment will fit within the space allotted for it.

F. Titles of Sections and Paragraphs in these specifications are introduced merely for convenience and are not to be construed as a correct or complete segregation or tabulation of the various units of materials or work. The Engineer does not assume any responsibility either direct or implied, for omissions or duplications by the Contractor and any Sub- Contractor due to real or alleged error in the arrangement of matter in the Contract Documents.

1.11 ENGINEER'S APPROVAL:

A. In any statement under this Contract where "approval" is required or requested, it is understood that such approval must be obtained from the Engineer in writing before proceeding with the proposal, and an adequate number of copies of such proposal shall be submitted to the Engineer.

B. The approval by the Engineer of any materials, changes, drawings, etc., submitted by the Contractor will be considered as general only and to aid the Contractor in expediting his work. Such approval as may be given does not in any way relieve the Contractor from the necessity of furnishing the material and performing work as required by the drawings and specifications.

1.12 LOCAL RESTRICTIONS:

A. Contractor shall become familiar with rules and regulations of the City, County, and State; or any other authority having jurisdiction over this project; and if, in his opinion, any work or materials shown on the drawings or specified do not comply with these rules and regulations as to size, type, capacity, and quality, he should make it known prior to the submission of his bid, which shall be deemed evidence of compliance; otherwise, the Contractor shall be responsible for the approval of work or material; and, in the event that any such authority should indicate disapproval, he shall correct same with materials approved by the Engineer at no additional cost to the Owner

1.13 ELECTRIC WIRING:

A. The Mechanical Contractor shall erect motors in place ready for power connection and where scheduled or indicated on plans, shall furnish with each such motor a starter of the type specified and deliver it in good condition to the Electrical Contractor for installation. The

Electrical Contractor shall mount such starters as directed, furnishing supporting structure where necessary. Those who furnish motors and equipment shall also furnish with each item necessary instructions and wiring diagrams to the Electrical Contractor. Refer to Electrical Sections of the Specifications to determine in further detail the scope of the electrical work.

B. Equipment actually installed on the project generally differs slightly from the equipment specified. To avoid incompatible branch service, prepare a list of electrical consuming items being installed in the project under this contract, which lists volts, phase, service factor, etc., of each and every piece of equipment or electrical device. Formally transmit the list to the Electrical Contractor to verify the compatibility of the electric service provided to each item. This coordination shall be completed prior to finalizing equipment and material purchases for the project.

C. If the Contractor furnishes motors differing in size from those scheduled, he shall notify the Electrical Contractor and make provisions for revised electrical and pay for any changes necessary.

1.14 RESPONSIBILITY:

A. Contractor shall be held responsible for the satisfactory and complete execution of work included. He shall produce complete finished operating systems and provide incidental items required as part of his work, regardless of whether such item is particularly specified or indicated.

1.15 GUARANTEE:

A. Contractor shall furnish a written guarantee in triplicate warranting all materials, equipment, and labor furnished by him to be free of all defects, for a period of one year from date of final acceptance by the Owner. He shall further guarantee that all equipment shall meet the characteristics, capacities, and workmanship specified; and should any defects or non-performance of equipment be indicated within the warranty period, the defects and/or equipment will be repaired or made good without cost to the Owner.

1.16 REFERENCE ABBREVIATIONS:

A. References are made in the various mechanical sections to technical societies, codes, specifications, trade organizations, and regulatory authorities in accordance with the following abbreviations:

1. AABC - Associated Air Balance Council
2. AFE- Air Filter Institute
3. AGA- American Gas Association
4. AMCA- Air Moving and Conditioning Association
5. ANSI- American National Standards Institute
6. ARI- Air Conditioning and Refrigeration Institute
7. ASHRAE- Society of Heating, Refrigeration and Air Conditioning Engineers
8. ASME- American Society of Mechanical Engineers
9. ASTM- American Society for Testing and Materials

10. AWSC- American Welding Society Code
11. AWWA- American Water Works Association
12. CISPI- Cast Iron Soil Pipe Institute
13. CTI- Cooling Tower Institute
14. FM- Factory Mutual
15. FS- Federal Specification
16. IRI- Industrial Risk Insurers
17. ISO- Insurance Services Organization
18. NAFM- National Association of Fan Manufacturers
19. NCPWB(MCAA)- National Certified Pipe Welders Bureau (Mechanical Contractors Association of America)
20. NFC- National Fire Codes
21. NFPA- National Fire Protection Association
22. PDI- Plumbing and Drainage Institute
23. SBI- Steel Boiler Institute
24. SMACNA- Sheet Metal and Air Conditioning Contractors National Association
25. UL- Underwriters Laboratories, Inc.

1.17 SHOP DRAWINGS AND DATA TO BE SUBMITTED:

A. SUBMITTALS WHICH DO NOT MEET THE FOLLOWING REQUIREMENTS WILL BE IMMEDIATELY REJECTED WITHOUT FURTHER REVIEW!!!

1. Catalog cutsheets and brochures will be preceded by a neatly arranged cover sheet having ample room for shopdrawing stamps and bearing the following information in a prominent, immediately visible location and size:

   a. Equipment name or number as referenced in the contract Documents (example: "AHU-A" or "Type A" light fixture).
   b. All options or accessories provided.
   c. Applicable Specification section and paragraph numbers.

2. Substitutions -

   a. Cross reference individual manufacturer and catalog numbers of substitute products to those of specified material.
   b. Prior to requesting permission to use substitute or alternate products, the Contractor shall investigate and make certain that the product-

      1) Conforms with the standard of performance and quality specified.
      2) Will physically fit in the space allocated, with sufficient access and maintenance space.
      3) Involves no additional costs to the Owner or extended construction time.

   c. Should the use of a substitute product entail any changes in details or construction, the changes and information documenting the complete coordination with all affected trades shall be submitted prior to approval of substitution.
   d. Provide with requests for permission to use substitute or alternate products, drawings, specifications, samples, performance data and other information as may

be required to assist in determination of acceptability of the product. The burden of proof is the Contractor's responsibility.

3. All similar or related items shall be submitted together under one cover sheet (i.e. fixtures, insulation, valves, equipment). Do not piece-meal submittals!!!

B. Equipment Items:

1. Submit manufacturer's certified data relative to equipment required for the installation of the HVAC, plumbing and fire protection systems.
2. Submit adequate engineering data on each piece of equipment to allow a careful check of compliance with the technical requirements of the Contract Documents. Clearly indicate on submittal data the manufacturer's name, piece number, equipment capacity, and other applicable technical data.
3. Submit the following data for Mechanical Systems-

a. Foundations, Supports, Hangers, Inserts.
b. Insulation.
c. Ventilation and Air Conditioning Equipment, Specialties and their Control Systems.
d. Plumbing Equipment, Piping, Fittings and Valves
e. Special Products Furnished by Mechanical Trades.
f. Openings, Special Framing and Access Doors.
g. Data for Testing and Balancing of the Heating, Air Conditioning and Ventilating Systems.
h. Installation Instructions - Submit Manufacturer's Printed Installation Instructions.
i. Temperature Controls.
j. HVAC Piping, Fittings and Valves
k. Air Devices.

1.18 INSTRUCTIONS:

A. The Contractor shall furnish the services of competent instructors who will give full instruction to designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements of the equipment in each mechanical system. Each instructor shall be thoroughly familiar with all parts of the installation.

B. The Contractor shall be responsible for videotaping all training sessions and shall submit two copies of the training videos on DVD discs.

C. The number and length of training sessions shall be as specified in the various Sections of the Specification.

D. These requirements are supplemented by requirements for specific equipment or systems in the various Sections of the Specification.

1.19 OPERATING AND MAINTENANCE MANUALS:

A. Bind in looseleaf binders with the words, "Operating and Maintenance Manual" and the Project identification imprinted on the cover. Prepare four complete sets of records for the Owner, with table of contents, index, and tabbed Section dividers.

B. During the construction period, accumulate the following for inclusion in the Operating and Maintenance Manuals-

1. Copies or warranties and guarantees on each piece of equipment installed.
2. Fixture brochures.
3. Wiring and Control Diagrams.
4. Approved Shop Drawings.
5. Operating instructions for-

    a. HVAC Systems.
    b. Temperature Controls.

6. Recommended maintenance procedures.
7. Lists of major items of equipment with name, address, and telephone number of each local representative.

C. Submit the manuals for approval at approximately 75 percent job completion.

D. Each manual shall consist of-

1. Complete description of each item of equipment and apparatus furnished and installed - including ratings, capacities, and characteristics.
2. Fully detailed parts list, including all numbered parts of each item of equipment and apparatus furnished and installed.
3. Manufacturer's printed instructions describing operation, servicing, maintenance and repair of each item of equipment and apparatus.
4. Typewritten record of all tests made of materials, equipment, and systems. All such records shall state the date tests were conducted, the names of all persons making and witnessing the tests, and citing any unusual conditions relevant to the tests.

1.20 RECORD DRAWINGS:

A. Accumulate Record Drawings during the construction of the Project. Keep one set of blueline Contract Drawings at the job site at all times, and mark changes, rerouting or modifications which occur, clearly on the Drawings with dimensions.

B. At completion of the job, deliver Record Drawings to the Engineer. Record Drawings shall be submitted for approval prior to final payment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer's names and catalog numbers are scheduled or specified for the purpose of establishing standard of design, quality, appearance, performance and serviceability, and not to limit competition. Scheduled products (as may be modified by detailed specifications) are those selected as the basis for system design with respect to physical size and space arrangements, required capacity and performance characteristics, and the product quality intended.

B. The Drawings indicate specified products physically arranged in the spaces, as cataloged by specific manufacturers, generally as listed in the Equipment Schedules.

C. Listed "Acceptable Manufacturer's" are those considered capable of manufacturing products conforming to detailed Specifications, and as such, are invited to compete on an equal basis provided the offering is comparable in every respect to scheduled or specified products and actually conforms to the detailed Specifications and Schedule requirements. Listing herein as "acceptable manufacturers" does not imply "accepted", "approved", or "prior approval", or any other such connotation. All product offerings must be submitted for approval after Contract award.

D. Vendors are invited to submit material or equipment bids to bidding Contractors on any comparable equivalent product, whether or not the manufacturer of such product is listed herein as an "acceptable manufacturer". Such product bids should clearly indicate offerings that are not listed as "acceptable manufacturers". In the event a bidding Contractor, after satisfying himself that such unlisted product is in fact "equal" to the specified product with respect to design, quality, performance and arrangement (space requirements), and the Contractor desires to furnish that product on the Project, he may request the name of the manufacturer be added to the list of acceptable manufacturers by addendum prior to bid time.

E. At a bidder's request, an unnamed manufacturer's equipment will be considered to determine additional "acceptable manufacturers" if a request is made in writing no later than ten days prior to the bid opening. If such requests are found acceptable, an addendum will be written listing additional acceptable manufacturers. Consideration will be given only to requests of bona fide bidders (Contractors), not to those received from vendors.

F. Manufacturers of materials and equipment shall be as specified, scheduled, or as listed in each respective product Specification Article.

2.2 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS:

A. Materials and adhesives used throughout the mechanical systems for insulation, acoustical lining, filters, ducts, flexible connections, and jackets or coverings regardless of kind, or for piping or conduit system components, shall have a flame spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating not higher than 50. (Note: materials need not meet these requirements where they are entirely located outside of a building and do not penetrate a wall or roof, and do not create an exposure hazard or where specifically exempted in the body of these Specifications).

B. "Flame Spread Rating" and "Smoke Developed Rating" shall be as determined by the "Method of Test of Surface Burning Characteristics of Building Materials, NFPA No. 255, ASTM E84,

Underwriters Laboratories, Inc., Standard". Such materials are listed in the Underwriters Laboratories, Inc. "Building Materials List" under the heading "Hazard Classification (Fire)".

2.3 IDENTIFICATION OF PIPING, AND EQUIPMENT

A. Identify mechanical equipment in main mechanical room only with nameplate bearing equipment name, number, module, and room(s) served (use room numbers on architectural plans), using bevel edges, 1/16-inch thick, 1 1/2- inch white laminated Bakelite with engraved black letters, 1/2-inch (double line) or 7/8-inch (single line) high, permanently mounted on the equipment in a conspicuous place with screws.

B. Markings - Identify each piping system in main mechanical room and immediately inside tunnel access doors with the direction of flow (where applicable) indicated by legends and flow arrows. The markings shall be applied after all cleaning of the piping and insulation is completed. Identify with semi rigid mechanically applied plastic marked bands with background color coded per ANSI A13.1. Color of lettering and flow arrow shall be black. Marker material shall completely encircle the pipe when smaller than 8-inch ips.

1. Provide 1/2-inch letters, 8-inch long color field on outside diameters less than 1 1/2-inch.
2. Provide 3/4-inch letters, 8-inch long color field on outside diameters of 1 1/2 to 2-inch.
3. Provide 1 1/4-inch letters, 12-inch long color field on outside diameters over 2-inch, but smaller than 8-inch.
4. Provide 2 1/2-inch letters, 24-inch long color field on outside diameters of 8-inch to 10-inch.
5. Provide 3 1/2-inch letters, 36-inch long color field on outside diameters larger than 10-inch.

C. The legend and flow arrow shall be applied at each valve location, and at each point where piping enters or leaves a wall, partition, bulkhead, cluster of piping or similar obstruction..

D. Variations or changes in locations and spacing shall be made to meet conditions.

E. Wherever two or more pipes run parallel, the printed legend and other markings shall be applied in the same relative locations so as to be in either vertical or horizontal linearity, whichever the case may be.

F. The markings shall be located so as to be conspicuous and legible from any reasonable point.

G. Standard pipe and conduit identification symbols.

1. CW - Domestic Cold Water.
2. HW - Domestic Hot Water.
3. THW - Tempered Domestic Hot Water.
4. HWR - Domestic Hot Water Recirculation.
5. SS - Sanitary Sewer.
6. SV - Sanitary Vent.
7. ST - Storm Drainage Piping
8. GAS - Natural Gas.
9. CHS – Chilled Water Supply.
10. CHR – Chilled Water Return.

11. HS – Heating Water Supply.
12. HR – Heating Water Return.
13. REF – Refrigerant.
14. D - AC Condensate Drain.

H. Underground Warning Tapes for Buried Lines-

1. Provide 3-inch wide metallic core brightly colored polyethylene detection tape, shallow buried in the trench above nonmetallic pipes, serving the dual purpose of line location and identification. The tape shall be easily detected by any commonly used metal detector and shall bear a printed message (continuous along entire length) describing the contents of the line beneath.
2. Provide 6-inch wide brightly colored polyethylene tape, shallow buried in the trench above metallic pipes, to identify the contents of the line beneath. The tape shall bear a printed message (continuous along entire length) describing the type of the buried line and its contents.

I. Provide valve tags schedules and valve charts for each piping system consisting of Schematic Drawings of piping layouts along with a valve list, showing and identifying each valve by number, service, and location and describing its function. Upon completion of the Work, mount two copies of each chart, sealed to rigid backboard with clear lacquer, placed under glass and framed, on the wall. Two additional unmounted copies shall be delivered to the Owner.

J. Valve Tags - Provide 1 1/4-inch x 1 1/4-inch square laminated plastic name tags with 1/4-inch engraved letters for all valves, with black letters on white tags, marked for type of service intended. Attach tags to valve handles by "S" hooks.

K. Nameplates and tags shall correspond to the Record Drawings.

L. Submit complete details of identification legends, color fields, and sizes, coordinated between trades.

M. Acceptable Manufacturers - Seton Nameplate Corporation, W.H. Brady, Westline.

2.4 BEARINGS

A. All bearings supplied to the Project, regardless of supply responsibility or applications as integral parts of machinery, shall be standard catalog items and interchangeable with those of manufacturers currently represented in the local trade area with replacements stocked locally. Ball bearings shall be radial or thrust design, sealed and enclosed in a dust and moisture proof housing, and selected in accordance with AFBM Rating B-10 for at least 200,000 hour operating life as applied. Grease lubricated bearings shall be arranged for regreasing through alemite fittings located outside machinery enclosures in a convenient location, with grease relief fittings in the bearing housing to prevent overgreasing or seal rupture.

B. Acceptable Manufacturers - Andrews, Dodge, Fafnir, Hyatt, Link-Belt, MRC, McGill, New Departure, Sealmaster, SKF, Shafer, Rollway, Thompson, Timken, Torrington.

2.5 ELECTRIC MOTORS

A. Shall conform to the requirements of IEEE, NEMA, and shall have voltage, phase, frequency and service as scheduled.

B. Each item of motor driven equipment shall be furnished complete with the motors, drives and control equipment, including remote pilot devices as required to perform the specific function for which it is intended.

C. Motors shall be sleeve or ball bearing type selected for quiet operation, shall be manufactured for general purpose duty, with each bearing accessible for lubrication, and designed for the load imposed by the drive.

D. Motors 1/2 horsepower and larger shall have bearings with pressure grease lubrication.

E. Motors connected to drive equipment by belt shall be furnished with adjustable slide rail bases except for fractional horsepower motors which shall have slotted bases. Motor leads shall be permanently identified and supplied with connectors.

F. Provide open dripproof enclosures for motors located indoors in dry locations, and splashproof enclosures in wet locations. Motors to be installed outdoors shall be totally enclosed fan cooled.

G. Unless otherwise scheduled, motors ½ horsepower and smaller shall be electronically commutated motors, designed for 120 volt, single phase, 60 Hz alternating current.

H. Unless otherwise scheduled, motors larger than ½ horsepower shall be premium efficiency and shall meet the requirements for premium efficiency motors as defined in NEMA MG 1, latest edition. Minimum efficiencies and power factors shall not be less than listed in NEMA MG 1. The motor nameplate shall bear the designation "PREMIUM EFFICIENCY" as well as the efficiency and power factor.

I. Unless otherwise scheduled, motors 1/2 horsepower and larger shall be squirrel cage induction type, for scheduled voltage, 3 phase, 60 Hz alternating current.

J. Each motor shall be free from magnetic hum, designed for quiet operation.

K. Each motor shall be suitable for the brake horsepower of the driven unit, rated with 1.15 minimum service factor, with the temperature rise not to exceed NEMA standards and shall be capable of withstanding momentary overloads of 25 percent without injurious overheating.

L. Electrical Specifications - Copper windings, winding insulation system NEMA Class B or better, wound for standard voltages. Motors shall conform to NEMA Design B as a minimum.

M. Mechanical Specifications - Frame dimensions conform to NEMA standards for "T-Frame" motors. Frame construction of motors larger than NEMA frame 145T of cast-iron or extruded aluminum construction and those of NEMA frame size 145T and smaller may be fabricated steel type. Nameplates shall be stainless steel. Grease lubricated ball or roller bearings shall be supplied unless otherwise specified. On NEMA frame sizes 182T and larger make provisions for regreasing by use of removable grease plugs.

N. Acceptable Manufacturers - Allis Chalmers, Baldor, Century, General Electric, Ideal, Lincoln, Louis Allis, Marathon, Reliance, U.S., Wagner, Westinghouse.

2.6 MOTOR STARTERS

A. Except where otherwise specified or scheduled, each starter shall be furnished by the supplier who furnishes the equipment it controls.

B. Provide a manual or magnetic starter for each motor. Where such devices are included in an "Equipment Control Schedule", they shall be as scheduled. Otherwise, they shall be as recommended by the equipment manufacturer.

C. Magnetic starters shall include overload protection for each phase wired with normally closed contacts in series control circuit ahead of any other control contacts on the control side of the solenoid coil, and no contacts between the other side of the solenoid coil and the control power source. Motor starters shall conform to NEMA Standards for Industrial Control for 3 phase motors, No. 1C-1, with 120 volt (maximum) control circuit and control power transformer.

D. Where individual starters and disconnect switches (or circuit breakers) are indicated to be in the same location, furnish combination devices in a common housing. Fused disconnects shall have rejection type fuse clips and Class RK-1 fuses.

E. In every instance where magnetic starters are not required, furnish manual starters for fractional horsepower single phase motors - "ON-OFF", snap switch type with soldered ratchet overload protection.

F. When interlocking or automatic control of single phase motors is indicated or required, the motors shall be furnished with magnetic across-the-line starters.

G. When interlocking or automatic control of electric heaters is indicated or required, the heaters shall be furnished with contactors. Provide control power transformers as required to maintain control circuit voltages not exceeding 120 volts.

H. Provide with each magnetic starter a reset button, pilot light, and HAND-OFF-AUTO switch, heavy duty type, mounted in starter cover. Provide field reversible (normally open or normally closed) auxiliary contacts required for interlocking but in no case less than two per starter.

I. Acceptable Manufacturers - Allen Bradley, Cerus, Cutler-Hammer, General Electric, I-T-E, Square D, Westinghouse.

2.7 ACCESS DOORS:

A. Furnish, for installation under appropriate Section of the Work, access doors at each point required to provide access to concealed valves, dampers, damper operators, and other devices requiring operation, adjustment, or maintenance.

B. Shall be 16 gage steel, with mounting straps, concealed hangers, and screwdriver locks, designed for the doors to open 180 degrees, minimum.

C. Access doors installed in fire walls or partitions shall be UL labeled to maintain surfaces.

D. Provide prime coat finish for installation in ceilings or painted or unfinished surfaces.

E. Provide polish chrome plate finish for installation in unpainted finished walls.

F. Acceptable Manufacturers - Baldwin, Hannon, Josam, Miami, Carey, Milcor, Titus, Wade, Walsh, Zurn.

2.8 METAL STRUT FRAMING SYSTEMS:

A. Shall be a basic adjustable slotted steel framing system consisting of components specifically designed for the support of mechanical and electrical systems. Parts shall include modular type channels, available with or without bolt holes, knockouts, or slots, with fittings and hardware requiring no welding, drilling, or other complex fabrication techniques. Basic attachment to channel shall be by means of spring mounted gripping nuts with serrated grooves, and bolts.

B. Available accessories shall include brackets, baseplates, rod connectors, pipe and conduit straps, pipe and conduit hangers, beam clamps, cable clamps, concrete inserts and closure strips.

C. Loading shall not exceed manufacturer's published load capacities for parts, connections, and assemblies for the actual spans involved.

D. Shall be UL listed for the purpose when utilized as electrical raceway.

E. Acceptable Manufacturers - B-Line, Elcen, F and S, Kindorf, Power Strut, Unistrut.

2.9 SLEEVES, INSERTS, ANCHORS AND SUPPORTS:

A. Provide in concrete, carpentry or masonry construction, hangers, sleeves, expansion bolts, inserts, supporting steel, or other fixtures necessary for the support of pipe, equipment and devices furnished under each Section of the Specifications.

B. Provide each pipe, conduit, or duct passing through walls, floors, ceilings or partitions with sleeves having internal dimension approximately 1-inch larger than the outside dimension (including installation) of pipes, conduits or ducts.

C. Sleeves through interior partitions and floors shall be no less than 22 gage galvanized steel, set flush with the finished surfaces.

D. Sleeves through mechanical room floor shall match existing.

E. Attachments to structure shall be by means of beam clamps wherever practicable.

F. Acceptable Manufacturers - Grinnell, Hilti, Phillips, or Thunderline.

2.10 FIRE STOPPING:

A. Seal annular spaces between sleeves and penetrating materials in fire rated floors, ceilings, and walls with fireproof and waterproof silicone elastomer applied in accordance with the manufacturer's published instructions. Multiple penetrations shall be sealed with silicone calking. Seal material shall be UL classified for use in fire rated penetration seals, and shall be

applied in the manufacturer's recommended thickness for the fire rating of the penetrated structure in accordance with ASTM-E-814 requirements.

B. Acceptable Manufacturers - Dow Corning, General Electric, Hilti.

2.11 WATERPROOFING:

A. Seal penetrations of wet or potentially wet structures, floors, exterior walls, etc., other than those requiring fire stopping, with sealant to prevent moisture leakage. Apply sealing material (calking) in accordance with manufacturer's published instructions.

B. Product Research and Chemical Co. "Poly-Sulphide Sealant" PRC- 5000.

2.12 AUXILIARY STRUCTURAL SUPPORTS:

A. Provide auxiliary structural supports as necessary to support mechanical systems from the building structure. Coordinate with structural drawings. Supporting members shall be metal strut framing or standard structural shapes, designed to support imposed loads with a working stress no greater than 25 percent of ultimate stress values of the members, and articulation with the building structure without exceeding structural limitations at the point of attachment to the building structure. Prepare calculations and Shop Drawings of each such support and submit for acceptance. Begin no work until receipt of acceptance from the structural engineer.

2.13 ESCUTCHEONS:

A. Provide escutcheons or 22 gage minimum painted galvanized sheet metal wall flanges (in event standard manufactured product does not exist) for mechanical or electrical penetrations of floors, ceilings, walls or partitions. Escutcheons shall be sized to enclosed the outside of the penetration sleeve and fit snugly to the pipe (or over outside of insulation) of insulated lines. Both exposed surfaces of such penetrated elements shall be fitted with escutcheons which shall both afford a finished appearance and prevent passage of vermin.

B. Except where otherwise specified, escutcheons shall be one- piece (where practicable) or split, hinged, stamped brass type designed to fit the pipe, and to cover the terminating pipe sleeve, in chrome plated finish, with securing device to hold the escutcheon tight to the pipe.

C. Use deep escutcheon on each sleeve set in a waterproof concrete floor.

D. Acceptable Manufacturers - Beaton and Corbin, Grinnell, Sweet and Donaldson.

2.14 ROOFTOP EQUIPMENT SUPPORTS AND PIPE CURBS:

A. Provide insulated, leakproof equipment supports and pipe curbs approved by the National Roofing Contractor's Association for roof mounted equipment, pipe, or conduits. Supports shall be prefabricated of continuous welded 18 gage minimum galvanized steel, 12-inch minimum height, mitered corner seams, integral cant and base plate, 2 x 4 fire resistant treated wood

nailer, and 18 gage counterflashing. Provide integral internal reinforcing necessary to support imposed load, but no less than 600 pounds per linear foot of perimeter.

B. Provide raised cant, thickness to match thickness of roof insulation.

C. Top surface shall be level. Provide pitched base where installed on pitched roof.

D. For pipe curbs, coordinate conduit requirements with Division 26, to provide required openings in a single curb.

E. Acceptable Manufacturers - Pate, Roof Products Systems, Stiles, Thycurb.

2.15 FLASHINGS:

A. Furnish weatherproof flashings for mechanical system related openings through the roof and walls.

B. Furnish roof flashing for round and rectangular openings, pipes, vents, machinery, devices, or ducts. The flashings shall be constructed to terminate not less than 12-inches above the roof. Provide suitable counterflashing constructed from the same material as the flashing.

C. Furnish flashings for mechanical curbs, and furnish and install counterflashing at each.

2.16 PIPE HANGERS AND SUPPORTS:

A. Hold piping in place by accepted hangers, supports and anchors, designed to support weight of pipe, weight of fluid and weight of pipe insulation. Arrange hangers to prevent transmission of vibration from piping to building and supports. Allow clearance for application of specified vapor sealed insulation without cutting pipeline covering or fitting covering in installation of pipe hangers and fittings. Uninsulated copper or brass pipe or tubing shall be isolated from ferrous hangers or supports. Piping shall not be supported from roof decking. Furnish and install angle members to span steel joists or distribute load.

B. Suspend and support horizontal and vertical piping from the structure with hangers and metal strut framing system or structural steel supports, spaced as scheduled. Furnish necessary accessories, nuts, lock nuts, bolts, rods and devices to allow installation to freely expand and contract. Hangers shall be formed steel clevis type, unless otherwise specified, with adjustable attachment to hanger rod. For copper or brass pipe, use plastic sheathed hangers to eliminate all possibility of galvanic action between hanger and copper tubing. Pipe hangers shall fit over vapor sealed insulated piping.

1. Clevis - Grinnel Fig. 260 or 590.
2. Uninsulated copper tubing - Grinnell Fig. CT-99C.

C. Where pipe exceeds maximum loading recommended for clevis type hanger and for attachment to vertical pipes, provide steel pipe clamps.

1. Double bolt pipe clamps - Grinnell Fig. 295.
2. Riser clamps - Grinnell Fig. 261.

3. Copper tubing riser clamps - Grinnell Fig. CT-121-C.

D. Provide trapeze hangers where several pipes can be installed parallel and at same level. Trapeze of standard structural steel shapes sized to support load and drilled for rod hanger at each end.

1. Grinnel Fig. 46.

E. Use roller supports with cast iron adjustable bases, where provision for expansion is required.

1. Grinnell Fig. 274.

F. For hanger rods on piping 3/4-inch thru 2-inch inclusive, use 3/8-inch thru 3 1/2-inch inclusive, use 1/2-inch rods; for 4- inch thru 5-inch inclusive, use 5/8-inch rods; for 6-inch, use 3/4-inch rods; for 8-inch thru 12-inch, use 7/8-inch rods; and for piping larger than 12-inches, use 1-inch rods.

G. Provide additional steel members required for hanging piping systems in areas with special conditions, or where vertical or horizontal structural steel supports are required other than those provided in the structure.

H. Provide oversize hangers with hanger shields or blocking the same thickness as insulation to pitch insulated pipes accurately at time of installation.

I. C-Type hangers on sprinkler piping shall have lock nuts.

J. Attach supporting rods to concrete by drilled anchors or inserts placed before concrete is poured.

K. Provide lateral bracing for supporting rods over 18-inches long braced at every fourth hanger with diagonal bracing attached to slab or beam.

L. Attach supporting rods to precast structural members on sides by expansion bolts located above steel reinforcing at minimum of 6-inches above the bottom. Power driven devices shall not be used.

M. Floor Supports - Provide for supporting horizontal piping from floors with cast-iron pipe rests, with pipe nipples to suit. Fasten to floor. Where provision for expansion is required, provide pipe roll stands, without vertical adjustment. Provide concrete or steel pipe piers; fasten stands to piers.

N. Wall Supports - Provide for supporting horizontal piping from wall with steel J-hook for pipe located close to wall and no larger than 3-inch pipe. For greater loads, up to 1500-pound maximum loading, provide welded steel bracket.

O. Use inserts of drilled anchors in concrete construction, use beam clamps in steel construction.

P. Hanger spacing schedule, except for nonmetallic, cast iron, or fire protection systems, shall be as follows:

1. 1/2 and 3/4-inches 6-feet
2. 1-inch 7-feet

3.	1 1/4-inch	8-feet
4.	1 1/2-inch	9-feet
5.	2-inch	10-feet
6.	Larger than 2-inches	12-feet

Q. Furnish miscellaneous steel necessary to support piping systems, including those accessories required for trapeze or group hanging.

R. Acceptable Manufacturers - B-Line, Grinnell, Burt Patterson, Elgen, F and S Fee and Mason,. Michigan, Modern.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT:

A. Protect equipment from physical damage and deterioration after it is delivered to the Project, and during the installation period prior to Owner acceptance.

B. The equipment shall be kept clean. Motors and electrical devices shall be covered with suitable materials to prevent dirt or dust accumulation within equipment. Machinery and devices shall be properly oiled and maintained to prevent rusting and deterioration.

C. Repair scratches, mars, or paint deterioration.

3.2 EXCAVATION AND BACKFILL

A. Perform excavation and backfill required for the installation of underground pipe, ducts, equipment and devices.

B. Cut trenches true and straight and grade bottom to afford uniform bearing of barrel on firm soil. Stack the excavation material in a suitable location. Shore trenches and excavated areas as required for safety, and for security of adjacent earth and structures.

C. Cut through walks, roads, and other structures as necessary for the installation.

D. Install underground mechanical piping and ducts with a minimum cover of 24-inches from finished grade, or as detailed on plans. Pipes carrying water shall be installed a minimum of six inches below the frost line.

E. Trench width at and below top of pipe shall result in horizontal clearance between trench wall and barrel on both sides.

F. Pipes smaller than 18-inch - at least 6, but no more than 8-inch clearance.

G. Prepare trench bottom. Dig out of joints. Lay pipe in trench so that entire length bears on firm soil. No part of bell fittings shall support the remainder of the pipe.

H. Provide embedment where indicated or if trench is unsuitable for support. Cut excavation a minimum of 6-inches below the required grade. A 6-inch bed of sand shall then be placed and properly compacted to provide accurate grade, and uniform bearing throughout the length of pipe or conduit. The sand shall consist of clean, natural, washed sand with particle sizes which will pass through a 3/8-inch screen, 90 percent through a quarter inch screen, and no more than 25 percent through a No. 50 screen.

I. The backfilling shall not be placed until the Work has been inspected, tested and accepted.

J. Backfill material shall be free of cinder or rocks, and free of clods or lumps larger than 1-inch, up to 12-inches above top of pipe, and 2-inches in remainder. If the excavated material is not suitable, provide adequate material from other locations.

K. Backfill by installing clean earth in accordance with the above Specifications in layers no more than 6-inches thick, tamping (and wetting down, if necessary). Hand place and tamp each layer of initial backfill in 4-inch layers up to pipe centerline, and in 6-inch layers up to 12-inches above the top of pipe. Complete backfill to grade and create a substantial, well-compacted trench to 95 percent compaction by the standard Proctor test.

L. Surplus earth or materials remaining after backfilling shall be removed from the site.

M. Repair utilities, lines, walks, and roads, and other surfaces and structures damaged by these operations to match conditions existing prior to excavation.

3.3 EQUIPMENT SPACE:

A. The Drawings indicate specified products physically arranged in the spaces, as cataloged by specific manufacturers, generally as listed in the Equipment Schedule.

B. Coordinate the exact physical space requirements for equipment and servicing of equipment actually purchased for each item of equipment involved.

C. Drawings show pipe and ductwork diagrammatically.

D. Adhere to Drawings as closely as possible in layout of work.

E. Vary run of piping, run and shape of ductwork and make offset during progress of work as required to meet structural and other interferences.

F. Install piping and ductwork in furred spaces wherever possible. Run exposed piping and ductwork parallel to or at right angles to buildings walls.

G. Keep horizontal lines as close to ceiling as practicable.

H. Conform to ceiling heights established on architectural construction drawings.

I. All equipment shall be installed to provide complete access for service, adjustment and filter replacement, as well as complete removal/replacement of unit from equipment room. Coordinate installation with all other trades to ensure that no piping, conduit, ductwork, structure, light fixtures, or other equipment obstruct complete access to the equipment.

Coordinate access requirements for equipment actually provided with equipment manufacturer. Equipment installation shall not impede access to room. Equipment installed in violation of these requirements will be removed and re-installed at contractor's expense.

3.4 INTERFERENCES:

A. Relocate or reroute existing pipe, wiring, or ducts as required to facilitate construction of finished work as planned. Restore surfaces, insulation, and finish to match condition of adjacent work.

3.5 CUTTING AND PATCHING:

A. Assume costs and responsibility for cutting and patching required to complete the installation.

3.6 PAINTING AND FINISHING AND CLEANING:

A. Provide touchup painting of prefinished mechanical products.

B. Surfaces shall be left clean, debris shall be removed, and equipment shall be furnished in prime coat finish ready for finish coats.

1. Piping, ductwork and equipment - Clean exterior of piping, ductwork and equipment, removing rust, plaster and dirt by wire brushing. Remove grease, oil, and similar materials by wiping with clean rags and suitable solvents.
2. Motors, pumps and other items with factory finish - Remove grease and oil and leave surfaces clean and polished.
3. Plumbing Fixtures - Clean and polish fixtures immediately prior to final inspection.

C. Cleaning operations are supplemented by detailed instructions for specific systems.

3.7 OPTION TO RELOCATE OUTLETS AND RELATED DEVICES:

A. Air supply outlets, return air inlets, exhaust air inlets, plumbing fixtures, and sprinkler heads may be relocated at the Owner's option to points within 10-feet of their indicated locations, at no additional cost to the Owner, provided the Contractor is notified prior to Shop Drawing preparation or roughing-in and fabrication.

B. Only work which must be re-performed in this connection will be considered extra.

3.8 MECHANICAL SYSTEM VERIFICATION AND CALIBRATION:

A. The mechanical contractor shall coordinate on-site system verification and calibration session(s) to document that the systems listed below are operating as intended. As a minimum, one 8-hour day shall be scheduled for the first session. Subsequent sessions shall be scheduled as needed until final verifications and calibration are complete.

1. The session shall follow complete installation and startup of all HVAC systems and the initial test and balance adjustments so that the integration effort will achieve the scheduled operation of each system.

B. Session(s) shall be scheduled in advance and the General Contractor, Owner and Engineer shall be invited to attend.

C. On-site attendance and participation in each session is mandatory for the following parties:

1. Equipment/system installing contractor.
2. Equipment manufacturer's factory authorized representative(s).
3. Temperature Controls Contractor.
4. Test and Balance Contractor.

D. Parts, tools and expertise:

1. The attending contractors and sub-contractors shall be equipped with typical components and materials to make corrections, adjustments and repairs of the installed equipment.
2. The participants shall bring necessary tools and special equipment needed to make corrections or adjustments of the installed equipment and sub-systems where operation is being verified and/or calibrated.
3. Personnel with the expertise to make full adjustments and/or programming changes shall be in attendance.

E. Documentation of system verification and calibration:

1. Verify the system operation through full operating range is correct by testing and measurement of the controlled variables and response of equipment during automatic operation. Verify through complete operating sequences put into effect by simulation of seasonal conditions by temporary adjustment of system setpoints and necessary control points.
2. The equipment/system Contractor shall prepare a record of the findings of the verification and calibration of each equipment item and/or system. The recorded findings shall identify the sequences verified and whether they were accepted or failed. Verification of system operation shall include:

    a. Operation sequences.
    b. Set points.
    c. Calibration and coordination of installed sensors and instrumentation.

3. The Contractor shall identify items that do not operate as expected and those requiring further verification

F. These requirements shall apply to the following equipment/systems:

1. New HVAC systems and equipment.
2. Temperature controls.

G. The Mechanical Contractor shall submit a report documenting the verification sessions and results for each piece of equipment affected. All deficiencies and deviations from the specified performance shall be documented.

END OF SECTION 23 01 00

SECTION 23 05 00 - HVAC MATERIALS AND METHODS

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Provide all pipe and fittings, piping specialties, valves, expansion joints, tanks, etc., as required for heating and air conditioning systems for the building.

1.2 SUBMITTALS:

A. Submit complete printed catalog and descriptive data for each piece of equipment, clearly indicating what features, options and accessories are being provided.

B. See Section 23 01 00.

PART 2 - PRODUCTS

2.1 PIPING SYSTEM MATERIALS:

A. HVAC Water Systems shall be one of the following:

1. ASTM A 53 black steel pipe, seamless or electric resistance welded. Sizes 12-inch and less shall be schedule 40.
2. Type "L" ASTM B-88, hard-drawn copper tubing. Provide dielectric isolators at all connections between copper and ferrous piping.
3. For pipe sizes 1-1/2 inches and smaller, Cross-linked polyethylene (PEX) may be used for the above water piping systems in lieu of steel or copper.

    a. Material Standard: Manufactured in accordance with ASTM F876 and ASTM F877 and tested for compliance by an independent third party agency.

        1) Standard grade hydrostatic design and pressure ratings from Plastic Pipe Institute.
        2) Minimum Bend Radius (cold bending): No less than 6 times the outside diameter. Use a bend support as supplied by the PEX tubing manufacturer for tubing with a bend radius less than stated.
        3) Nominal Inside Diameter: Provide tubing with nominal inside diameter, in accordance with ASTM F876.

    b. Fittings:

        1) Joints below grade shall be avoided if possible.

2) Fittings shall be of a type approved by the piping manufacturer for the application, and shall be supplied by piping manufacturer.
3) Material: Fittings shall be suitable for direct burial in earth, and shall be manufactured from one of the following –
4) Same material as piping.
5) Pollyalloy (ASTM 2359).
6) Bronze (w/ stainless steel sleeve) (ASTM 877).
7) Dezincified brass (ASTM 1807).
8) Material Standard: Comply with ASTM F1960.

c. Accessories

1) Bend supports designed for maintaining tight radius bends shall be supplied by the PEX tubing manufacturer.
2) Tools required to install the piping fittings shall be supplied by the PEX tubing manufacturer.
3) The tubing manufacturer will provide clips and/or PEX rails for supporting tubing runs.

d. Warranty:

1) Warranty Period for PEX piping and fitting system shall be 25-year, non-prorated warranty against failure due to defect in material or workmanship, beginning with date of substantial completion.

e. Acceptable Manufacturers – Mr. Pex, Uponor, Viega.

B. All piping, fittings, valves and piping accessories shall be rated for a minimum working pressure of 125 psi (at maximum operating temperature), or 150 percent of the system operating pressure (at maximum operating temperature), whichever is the greater.

2.2 COPPER FITTINGS:

A. Fittings for copper pipe shall be one of the following:

1. Recessed solder- joint type of either wrought copper or cast brass. Adapters for connection to threaded valves, fittings, meters and other equipment shall be cast brass. Recesses shall be smooth and correctly sized to provide proper clearance over the tubing.

a. Solder for water systems shall be composition 95/5 tin-antimony or Brigit. Flux shall be noncorrosive. The solder shall contain no lead.

2. Copper-tubing sized for grooved connections; wrought copper ASME B16.22 or cast bronze ASME B16.18. Victaulic Copper Connection.
3. Viega ProPress Fitting: Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have SC (Smart Connect) feature design (leakage path). Smart Connect ™ (SC Feature) In

ProPress ½" to 4" dimensions the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. The function of this feature is to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.

4. Grooved joint couplings assembly shall be securely held together by two trackhead, square or oval neck, steel bolts. Bolts and nuts shall be heat treated carbon steel and shall be in accordance with ASTM A-449 and A-183. Couplings shall be rigid Type, with housings cast with offsetting angle-pattern bolt pads to provide rigidity, at copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not allowed.).

    a. 2-inch through 4-inch: "Installation-Ready" for direct stab installation without field disassembly, with Grade 'EHP' gasket, rated to 250° F. Victaulic Style 607 Quick-Vic.
    b. 2-inch through 8-inch: Victaulic Style 606, with FlushSeal® gasket.

2.3 THREADED FITTINGS FOR WATER PIPE:

A. Pipe fittings for threaded steel pipe, where neither the static nor the operating heads exceed 125 psi, shall conform to the following ANSI Standards:

1. Cast Iron (threaded), 125 lb., ANSI B16.4, black or galvanized to correspond with pipe material.
2. Malleable Iron (threaded), 150 lb., ANSI B16.3, black or galvanized to correspond with pipe material.
3. Cast Iron (flange fittings), 125 lb., ANSI B16.1.

B. In lieu of threaded cast iron fittings on ferrous pipe, Contractor may elect to use threaded ductile iron or steel fittings provided they conform to the pressure classification requirements for cast iron fittings.

2.4 UNIONS AND FLANGE FITTINGS:

A. Unions smaller than 2-inch shall be in accordance with FS WW-U- 531 Type A, or B, as required to match adjacent piping. Union of 2-inch, 2 1/2-inch and 3-inch sizes shall be either cast iron or steel and flanges of 4-inch size and larger shall be forged steel. Forged steel flanges shall be 150 psi class slip-on or welding-neck flanges manufactured and marked in accordance with ANSI B16.5.

B. Where space will permit bolting from either side of flanged joint, carbon steel machine bolts and nuts conforming to the requirements of ASTM A 307, Grade B, will be permitted for use with flanges up to and including 150-pound class. Where space does not permit installation of bolts, full threaded carbon steel studs and nuts equal in requirements to the machine bolts shall be used for flanges up to and including 150-pound class. For all flanges heavier than 150-pound class, alloy steel studs and nuts shall be used for bolting; studs shall conform to the requirements of ASTM A 193, Grade B 7, and nuts shall conform to the requirements of ASTM A1954, Grade 7.

C. Flanges shall be spot-faced or back-faced parallel to the flange faces. Flanges heavier than 150-pound class shall be provided with grooved faces.

D. Unions and flanges for servicing or disconnect are not required in installations using grooved mechanical joint couplings. (The couplings shall serve as unions and disconnect points.)

2.5 WELDED FITTINGS:

A. In lieu of threaded or flanged fittings, Contractor may, except at unions, fusion weld ferrous piping using welding rod of same material as pipe. Piping 2-inch size and larger shall be butt welded, and piping 1 1/2-inch size and smaller shall be connected with socket welding or threaded fittings.

B. Factory made welding fittings shall be used for elbows and reducing fittings; mitered joint elbow and field made reducers shall not be used. Branch connections may be made with tees, factory made forged steel saddles, factory made shaped welding nipples, flared outlets, or shop fabricated butt welded branch having eliptical shaped nipple. Welding fittings shall be of the same wall thickness as the pipe in which they are installed.

C. Welding fittings, outlets and flanges shall comply with the latest edition of the following standards and specifications:

1. Butt Welding Fittings* - ANSI Standard B16.9*
2. Socket Welding Fittings - ANSI Standard B16.11
3. Wrought Carbon Steel - ASTM Specification A234
4. Welded Flanges - ANSI Standard B16.5
5. Forged Steel, General Purpose, for forged steel flanges, for pressures above 300 psi class* - ASTM Specification A105
   *Except for reducers, welding fittings need not comply with Section 6 of ANSI B16.9 provided they comply with all other applicable sections.

2.6 MECHANICAL PIPE COUPLINGS:

A. Mechanical pipe couplings may be used-for connecting equipment to the piping system, headers, and distribution piping in lieu of unions or welded, flanged, or screwed pipe connections or soldered tube connections for water piping with temperatures from -30°F to 230°F (with EPDM gaskets).

B. Couplings shall be self-centering and shall engage and lock in place the grooved or shouldered pipe and pipe fitting ends in a positive watertight couple. Fittings shall provide some degree of angular pipe deflection, contraction, and expansion where required.

C. Coupling housing clamps shall consist of two-ductile iron castings complying with ASTM A-536. Housing clamps shall hold in place a composition water sealing gasket designed so that internal water pressure serves to increase the seal's watertightness.

D. Couplings assembly shall be securely held together by two or more trackhead, square or oval neck, steel bolts. Bolts and nuts shall be heat treated carbon steel and shall be in accordance with ASTM A-449 and A-183. Couplings shall be

1. 2-inch through 12-inch:

a. Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.

1) 2-inch through 6-inch: "Installation-Ready" for direct stab installation without field disassembly, with Grade 'EHP' gasket, rated to 250° F. Victaulic Style 107 Quick-Vic.
2) 2-inch through 12-inch: Victaulic Style 07 Zero-Flex

b. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of a flexible connector. The couplings shall be placed in close proximity to the source of the vibration. Victaulic Style 77.
c. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741.

2. 14" through 24": Victaulic AGS series with lead-in chamfer on housing key and wide width FlushSeal® gasket.

a. Rigid Type: Housing key shall fill the wedge shaped AGS groove and provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9. Victaulic Style W07.
b. Flexible Type: Housing key shall fit into the wedge shaped AGS groove and allow for linear and angular pipe movement. Victaulic Style W77.
c. Flange Adapter: Flat face, ductile iron housings with elastomer pressure responsive gasket, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style W741.

3. Couplings shall be used according to the manufacturer's published temperature and pressure ranges.

E. All pipe fittings connected to mechanical pipe couplings shall have groove or shouldered ends and shall be fabricated of-ductile iron in accordance with ASTM A536; wrought steel in accordance with ASTM A234; or factory fabricated (and tested) from steel pipe conforming to ASTM A53.

F. Before couplings are assembled, pipe ends, gasket lips, and outsides of gaskets shall be lightly coated with Victaulic Lubricant-to facilitate installation.

1. Lubricant shall be supplied by the coupling manufacturer and shall be suitable for the gasket elastomer and system media.

G. The pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. The dimensions should be according to the

standard cut groove or roll groove specifications as recommended by manufacturer. Pipe grooving in the field shall be accomplished utilizing an automatic depth stop grooving tool. Coupling manufacturer shall provide Pi tapes, 'Go/No-Go' gauges, etc. to verify groove dimensional requirements are in compliance with standards.

H. Pipe and fitting assembly requires that all nuts shall be tightened to assure firm and visual metal contact of the coupling pads.

1. Couplings that require exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.

I. All grooved products shall be of the same manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

J. Entire coupling installation shall be in accordance with the latest published manufacturer's recommendations.

K. The grooved coupling manufacturer's factory trained representative shall provide on-site training for contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor's representative is not considered qualified to conduct the training or jobsite visit(s).)

L. Acceptable Manufacturers - Victaulic.

2.7 SLEEVES AND PLATES:

A. See Section 230100.

2.8 PIPE HANGERS AND SUPPORTS:

A. See Section 230100.

2.9 VALVES, GENERAL:

A. Valves in water service shall be of the ball type, or butterfly type.

B. Valves in water system pump discharge connections shall be of the ball or butterfly type.

C. Valves shall have a working pressure of 125 psi or 150 percent of the system operating pressure, whichever is the greater.

D. Provide extended neck valves where installed in insulated piping.

E. Ball and Butterfly Valves: All nonmetallic components and elastomers shall be suitable for 200°F minimum continuous operating temperature, or not less than 50°F. above the operating temperature of the system, whichever is higher. All mating surfaces of closure faces shall be of bronze or Type 304 316, 17-4PH stainless steel, or elastomer, approved for the particular service, and materials must be compatible to prevent poisoning of contact surfaces of different materials (electrolytic action). Each valve shall be provided with handle or wheel which shall be secured to the stem or chained to the valve body. Ball and butterfly valves shall be designed for dead end service and bubble tight shutoff.

1. Ball valves shall be used on lines 2-inches and smaller.

    a. Valves shall have bronze body, stainless steel ball and teflon seat with flanged or threaded ends, and shall be Style 1 (valve serviceable without disturbing piping connection), except that valves with bolt through or flanged bodies may be furnished. Valves 1-inch size and smaller, used exclusively for balancing, may be forged brass, Styles 2 or 3. Valves used in runouts to room heating and cooling units may have sweated ends or compression type fittings.
    b. Valves shall have forged brass body, chrome-plated brass ball and stem, TFE seat, fluoroelastomer seals, with Vic-Press 304™ ends. Valves may be used for balancing and shutoff. Valves shall be rated to 300 psig CWP. Victaulic Series 589.
    c. Grooved end valves for sizes through 6” shall have ductile iron body, chrome-plated steel or fully stainless steel ball and stem, TFE seats, fluoroelastomer seals, with lever handle or gear operator. Victaulic Series 726.

2. Butterfly valves may be used on lines larger than 2-inches. Valves shall be resilient seated type, provide tight closure, and shall be structurally designed to provide closure against the system operating pressure. Valve shall have ductile iron or cast iron body, stainless steel disc or coated ductile iron disc, stainless steel stem, reinforced teflon bushings and EPDM pressure responsive or disc mounted seat. (Stem shall be offset from the disc centerline to provide full 360-degree circumferential seating.) Shaft seals shall be of the "O" ring type. Stems, discs, and operators shall be designed for a water velocity of 16 feet per second through the nominal pipe area with no downstream obstructions. Bodies shall be flanged or wafer type. Valve flanges shall be of the same class as required for the lines in which they are installed. Valve 8-inches and large shall be provided with enclosed worm gear or traveling nut type operators equipped with lubricating fittings, or be permanently lubricated. Valves which serve to isolate systems to permit removal of equipment shall have bodies with integral flanges, or full lugs drilled and tapped, to hold valve in place when piping or equipment is removed. Valves installed with mechanical couplings shall have grooved or shouldered ends suitable for the approved couplings. Valves in insulated line shall have extended necks to accommodate the thermal insulation covering. Victaulic MasterSeal (sizes through 12-inches or AGS-Vic300 (sizes 14-inches through 24-inches).
3. Butterfly valves for grooved end copper-tubing systems 2 1/2-inches through 6-inches shall have cast bronze body conforming to ASTM B584, elastomer coated ductile iron disc with integrally cast stem, nickel plated 416 stainless steel upper and lower stem nuts, and elastomer seals. Ends shall be grooved, manufactured to copper-tube dimensions. Valves shall be lever or gear operated. Victaulic Style 608.

F. Nonslamming Check Valves: Nonslamming or silent check valves shall be of the fully guided conical spring, torsion spring actuated type or cone and diaphragm type. Bodies shall be grooved end, flanged or wafer type and shall be constructed of ductile or malleable iron, stainless steel or cast bronze in accordance with the following specifications:

1. Ductile Iron: ASTM Specification A536
2. Malleable Iron: ASTM Specification A-47
3. Cast Steel: ASTM Specification A-216, Class WCB.
4. Cast Bronze: ASTM Specification B-61.

G. Seats, discs and springs shall be constructed of 18-8 and/or 300 series stainless steel, or bronze complying with ASTM B-62. Seats may be elastomers, suitable for 230°F minimum continuous operation temperature, or not less than 50°F, above the operating temperature of the systems, whichever is higher. All mating surfaces of the closure faces shall be of bronze, welded-in nickel, or Type 304, 315 or 17-PH stainless steel, or elastomer, approved for the particular service, and materials must be compatible to prevent electrolytic action.-

1. Nonslamming check valves shall provide bubble tight shutoff when handling water up to 230°F., and shall be designed to prevent rubbing of seat material when opening and closing. Poppet type valves shall have conical springs.
2. For grooved end piping systems, Victaulic Series 716 and Series W715 shall be used.

H. Acceptable Manufacturers - DeZurik, Milwaukee, Nibco, and Victaulic, Watts.

2.10 WATER FLOW BALANCING PROVISIONS:

A. Each space cooling or heating device (coil, air unit, unit heater, fan-coil unit, baseboard radiation, etc.) shall be installed with provisions for measuring entering and leaving temperatures and pressure differential.

1. Every device shall have a ball or butterfly valve in supply line for service and a ball or butterfly valve with memory stop in the return line for balancing and service.
2. Every device shall have a P/T test plug in the supply and return line for direct insertion of a pressure gauge or thermometer.
3. Where 3-way mixing valve control is required, a P/T test plug shall be installed between the coil outlet and valve inlet. A P/T test plug shall be installed in the line on the outlet side of the valve. A ball or butterfly valve with memory stop shall be installed in the bypass line to the valve inlet.
4. P/T test plugs shall be located as close as possible to equipment connections.

2.11 SAFETY AND RELIEF VALVES:

A. Water Relief Valves: Provide water relief valves as indicated, of size and capacity as selected by Installer for proper relieving capacity, constructed in accordance with ASME Boiler and Pressure Vessel Code.

1. Pressure Relief Valves: Construct of bronze body, metallic disc, metal seat, with nonmechanically guided stem. Set valve to relieve at 10 psi above operating pressure, or as indicated on Drawings.
2. Acceptable Manufacturers - Amtrol, Inc., Bell & Gossett, ITT, Sarco Co., Watts Regulator Co.

2.12 BALANCING TAPS (TEST PLUGS):

A. Universal test connections for use either with thermometer or gage consisting of a brass case with cap and seal, 1/4-inch ips male thread connector and neoprene valve for insertion of stab connector.

B. Pressure rating of fittings shall be equal to or greater than the piping system in which installed.

C. Furnish 2 each gage adapter fittings and thermometers (25-125 and 50-500°F).

D. Acceptable Manufacturers - Fairfax, Peterson (Pete's Plug), Sisko.

2.13 DIELECTRIC ISOLATORS:

A. Dielectric isolators shall be so designed that no nonferrous materials come in contact with ferrous materials. These materials shall be isolated by the use of Teflon or nylon isolating materials made up in the form of screwed type unions of insulating gaskets and bolt sleeves and washers for standard flanged connection. Where it will not be necessary to disconnect these piping systems, the connections may be made by the use of Schedule 80 CPVC nipples, CPVC nylon or Teflon bushings. Insulating units shall be selected for pressures and temperatures to be encountered.

B. Acceptable Manufacturers - EPCO, Crane, F.M. Maloney, Universal, Walter Vallett.

2.14 AIR VENTS:

A. Automatic air vents shall be direct acting or compound lever action cast iron body, stainless steel float, bronze linkage, and noncorrosive seat.

B. Manual air vents shall be lever handle brass cocks.

C. Acceptable Manufacturers - APCO, Armstrong, Bell & Gossett, Clark, Golden Anderson, Hoffman, Sarco.

2.15 STRAINERS:

A. Provide strainers-

1. At inlet to automatic control valves with 0.020- inch mesh screen.
2. At pump suctions with 0.25-inch mesh screen.
3. Of same or higher temperature and pressure rating as piping system in which installed, and compatible connections.
4. With stainless steel or monel screens unless specified otherwise.
5. With bronze bodies and screen in copper piping.
6. With cast semisteel, cast steel, forged steel or cast iron body as required for the pressure rating of the system unless specified otherwise.

B. Provide Y pattern strainers with screwed or bolted cap except as otherwise indicated.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION:

A. Installation Compliance. Install all equipment and system components in accordance with manufacturer's instructions and as shown on the drawings.

3.2 AIR VENTS:

A. Install automatic air vents on coil systems and at high points in pipes of appropriate pressure ratings for point of installation, but in no case less than 150 psi.

B. Extend vent pipes from automatic vents from vent point to drain at visible and accessible location.

3.3 UNIONS:

A. Provide a union connection at each piping connection to each item of equipment.

B. Unions on threaded piping systems shall be ground joint malleable iron, with finish to match piping.

C. Unions on piping systems 2 1/2-inch and large shall be companion flange design complete with gaskets, bolts and nuts.

D. Unions shall be of appropriate pressure rating for the point of installation, but in no case less than 150 psi.

3.4 JOINING PIPE:

A. Furnish labor, materials, and supplies for the proper joining of each piping system.

B. Welding of piping systems shall conform to American Standard B31.1 and American Welding Society Standard B3-0.

C. Copper Water Piping, Soldered - Cut ends square, ream and polish pipe surface, polish inside of socket fitting. Tubing ends and fitting recesses shall be thoroughly cleaned. Apply flux to pipe into fitting, align, apply heat and solder, sweat together. Solder shall penetrate fully and shall fill the joint completely.

D. Copper, Grooved – Copper tubing may be roll grooved at copper-tube dimensions. (Flaring of tube or fitting ends to accommodate alternate sized couplings is not permitted.) The pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. The dimensions shall be according to the roll groove specifications as recommended by the manufacturer. Pipe grooving in the field shall be accomplished utilizing an automatic depth stop grooving tool with roll sets for copper tubing. Pipe and fitting assembly requires that all nuts shall be tightened to assure firm metal contact of the coupling pads. Manufacturer's field service engineer/representative shall provide on site training to insure installers adhere to manufacturer's installation instruction. (A distributor's representative shall not be considered qualified to conduct the training.) All grooved products shall be manufactured by Victaulic.

E. Steel, Threaded - Cut square, thread with tapered thread, use adequate quantity of cutting oil, ream end of pipe, apply thread compound, insert into fitting and makeup.

F. Steel, Welded - Cut square, ream, set fitting and tack, check for squareness, weld electrically, use coated electrodes compatible with pipe, chip welds, brush clean. Seal weld slip -on flanges internally, as well as fillet weld externally.

G. Steel, Grooved - Grooved black iron or steel pipe may be cut or hydraulically roll grooved; however, galvanized iron pipe shall only be hydraulically grooved. The pipe ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. The dimensions shall be according to the standard cut groove or roll groove specifications as recommended by the manufacturer. Pipe grooving in the field shall be accomplished utilizing an automatic depth stop grooving tool. Pipe and fitting assembly requires that all nuts shall be tightened to assure firm metal contact of the coupling pads. Manufacturer's field service engineer/representative shall provide on site training to insure installers adhere to manufacturer's installation instruction. (A distributor's representative shall not be considered qualified to conduct the training.) All grooved products shall be manufactured by Victaulic.

H. Copper and Stainless Steel Press-Fit Systems (Viega ProPress or Victaulic Vic-Press 304™): Install in accordance with manufacturer's recommendations. Pipe shall be approved by manufacturer for use with fittings. Piping shall be square cut, properly deburred, and cleaned. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

I. Copper Refrigerant Piping - Cut ends square, ream and polish pipe surface, polish inside of socket fitting. Tubing ends and fitting recesses shall be thoroughly cleaned. Apply flux to pipe

into fitting, align, apply heat and solder, sweat together. Solder shall penetrate fully and shall fill the joint completely.

1. Flow dry nitrogen inside pipe while soldering refrigerant pipe.

J. PEX Piping – Piping joints shall be made in accordance with manufacturer's instructions.

3.5 PIPING INSTALLATION:

A. Above Grade - Run level and as high as possible. Install hangers per schedule. Install to allow for expansion and contraction. Anchor where shown and where required. Allow access to equipment, for removal of heads, for servicing of the device. Support piping from beams, joists, or other structural supports.

B. Do not route piping above electrical distribution equipment, per National Electric Code.

C. Closed Circulating Water Systems - Run level, square to building, as high as possible. Install hangers per schedule. Vent high points, drain low points. Install valves on each side of each piece of equipment. Install valves at strainers. Provide valves and flanges to allow removal of heads and servicing of equipment without draining piping system. Install cutoff and drains to allow drainage of all pipes subject to freezing. Set control valves.

D. Pipe size changes in horizontal pipes containing liquid shall be made with eccentric reducers where necessary to allow complete system drainage.

E. Where piping must be run exposed to view, obtain prior approval of routing from the Architect. Coordinate with the Electrical Contractor so that exposed conduit and piping are grouped together.

F. Copper Piping Installation:

a. Isolate copper pipe from concrete at all locations where piping penetrates concrete or masonry construction.

G. PEX Piping Installation:

1. Do not proceed with installation of the PEX potable water system until unacceptable conditions are corrected.
2. Install PEX tubing in accordance with the tubing manufacturer's recommendations and as indicated in the installation handbook.
3. Joints below grade shall be limited to those required for tees and connection to valves at connections to buildings.
4. Do not solder within 18 inches of PEX tubing in the same waterline. Make sweat connections prior to making PEX connections.
5. Do not expose PEX tubing to direct sunlight for more than 30 days.
6. Ensure no glues, solvents, sealants or chemicals come in contact with the tubing without prior permission from the tubing manufacturer.
7. Protect PEX tubing with sleeves where abrasion may occur.

8. Use tubing manufacturer supplied bend supports where bends are less than six times the outside pipe diameter.
9. Minimum horizontal supports are to be installed not less than 32 inches between hangers in accordance with model plumbing codes and the installation handbook.
10. Pressurize tubing with air in accordance with applicable codes or in the absence of applicable codes to a pressure of 25 psi (173 kPa) above normal working pressure of the system.
11. Comply with safety precautions when pressure testing, including use of compressed air, where applicable. Do not use water to pressurize the system if ambient air temperature has the possibility of dropping below 32 degrees F (0 degrees C).
12. Field Quality Control:

    a. Manufacturer's Field Services: Provide manufacturer's field service consisting of product use recommendations and one site visit for inspection of product installation in accordance with manufacturer's instructions.

3.6 PIPE HANGERS AND SUPPORTS:

A. See Section 230100.

3.7 COMPLETION:

A. Complete entire piping systems. Properly support the system, clean the interior surfaces of the pipe, leave strainer baskets clean, all system filled and free from air, and ready for operation testing.

3.8 DIELECTRIC ISOLATION:

A. Wherever copper, brass or bronze systems or equipment are connected to steel or iron piping systems or equipment, this connection shall be made with dielectric isolators.

B. Arrange pipe hangers and supports such that electrical continuity is essentially nonexistent between ferrous and nonferrous piping, structure, materials, or equipment.

3.9 COMPLETE SYSTEMS:

A. Install devices required in the piping system regardless of the responsibility of supplying them. Specifically, install automatic control valves, flow switches, pressure taps, thermometer wells, orifice flanges and miscellaneous devices.

3.10 VALVES:

A. Provide shut off valves at the inlet and outlet of each piece or equipment, ahead of control valves, and as shown. Provide drain valves at low points to allow complete drainage of each closed pressure piping system. Provide vent valves at high points to allow complete venting of each closed pressure piping system. Install valves with stems horizontal or inclined above horizontal. Locate manual valves, control valves, and accessories in accessible areas to provide ready access for operation and maintenance.

3.11 TESTING PIPING SYSTEMS:

A. See Section 23 99 00.

END OF SECTION 23 05 00

SECTION 23 25 00 - INSULATION (MECHANICAL)

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Thermal insulation of piping systems, plumbing, casings and equipment installed under other Sections of these Specifications.

1.2 REFERENCE STANDARDS:

A. ASHRAE 90A - 1980, Section 5.

B. NFPA 90A, Air Conditioning and Ventilation Systems.

C. UL Guide No. V.8.15 (Jackets, Adhesives and Sealers).

D. SMACNA, Sheet Metal and Air Conditioning Contractors National Association.

1.3 SUBMITTALS:

A. Submit manufacturer's product data on insulation materials, jackets, accessory materials, adhesives, tapes, etc. Submit a schedule for each class of insulation specified, indicating product, thickness, quantities, sizes, installation details, and surfaces to which each class is to be applied.

B. See Section 23 01 00.

1.4 QUALIFICATIONS:

A. Insulation shall be installed by a firm whose principal business is the application and installation of thermal insulating material on piping and duct systems. Materials shall be by recognized manufacturers and shall be installed by skilled mechanics in accordance with manufacturer's standard published instructions except as otherwise specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Accessory Materials - Childers, Fosters, P.K. Insulation, Vimasco.

B. Insulation Material - Armstrong Cork, CertainTeed, Delta Systems, Inc., E.O. Wood, Fibrex, Knauf Fiber Glass, Manville, Owens-Corning Fiberglass, Partek.

2.2 ACCESSORY MATERIALS:

A. Hanger Adhesive - Foster 55, red-brown, or approved equivalent.

B. Insulating Cement - P.K. Insulation Quick Coat or One Coat, or approved equivalent.

C. Metal Bands - 1/2-inch wide, 0.20-inch thick aluminum.

D. Flexible Cellular Insulation Adhesive - Armstrong 520 or Foster 82-40, or approved equivalent.

E. Glass Fabric Cloth - 8 ounce per square yard sized woven cloth.

F. Glass Fabric Cloth Jacket Sealer, UL listed lagging adhesive, white - Foster 30-36, or Childers CP-50 pigmented, or approved equivalent.

G. Vapor Barrier Mastic, White - Foster 30-35 or Childers CP-30, or approved equivalent.

H. Weather Barrier Mastic, White - Foster 35-00 or Childers CP-10, or approved equivalent UL classified outdoor grade elastomeric vinyl mastic.

I. Fiberglass Insulation Bonding Adhesive, Amber-Foster 85-15 or Childers CP-82, or approved equivalent.

J. Mechanical Surface Fasteners – Benjamin Foster, Duro Dyne, Manville.

2.3 INSULATION JACKETS:

A. ASJ Jacket - All Service Jacket - Vinyl coated and embossed vapor barrier laminate of 40 pcf white kraft, aluminum foil, and flame snuffing adhesive, reinforced with glass fibers, 0.05 permeability rating.

B. PVC Jacket - 20 mil minimum thickness polyvinyl chloride pipe and fitting jacketing, UV resistant with maximum of 25/50 flame/smoke spread rating per ASTM 84. Install with waterproof solvent welding contact adhesive, vapor barrier mastic adhesive, and PVC tape. Do not staple or penetrate vapor barrier.
   1. Equivalent to Johns Manville Zeston.

2.4 TYPE FDL INSULATION:

A. Fiberglass Duct Liner, blanket material in roll form, meeting the requirements of ASTM C1071 and the additional following requirements.

1. Have a potential heat value not exceeding 3500 btu/lb when tested in accordance with NFPA 259 and meeting the classification of "Limited Combustible" as defined by NFPA 90A.
2. Maximum rated velocity not less than 5000 FPM when tested in accordance with ASTM C 1071.
3. Resistant to microbial growth using a "no growth criteria" when tested in accordance with ASTM C 1138, G 21 and G22.
4. Have a maximum thermal conductivity(k-value), at 75°F mean temperature, of .24 Btu.•in/hr.•sq.ft.•°F.
5. Sound absorption coefficients and NRC shall meet or exceed the following when tested in accordance with ASTM C 423 using an "A" mounting.

		Absorption Coeficients @ Octave Band Frequencies (Hz)						
Thickness	Type	125	250	500	1000	2000	4000	NRC
1/2"	200	.05	.15	.35	.61	.75	.88	.45
1"	150	.06	.27	.66	.87	.98	.99	.70
1-1/2"	150	.18	.53	.97	1.06	1.06	.90	.90
2"	150	.24	.74	1.12	1.11	1.07	1.08	1.00

B. Fiberglass Duct Liner shall be equivalent to Certainteed Tough Gard R.

2.5 TYPE FDB INSULATION:

A. Foil Faced Fiberglass Duct Wrap Blanket, UL labeled, reinforced foil kraft vapor barrier jacket, 0.30 K factor 75°F, mechanically fastened to duct using insulation pins welded to duct. Insulation pins shall not penetrate to the inside of ducts.

B. Conforming to FS HH-I-558B, Form B, Type 1, Class 6, ASTM C- 553.

2.6 TYPE FBW INSULATION:

A. Equivalent to 3M Fire Barrier Duct Wrap 615+, Lightweight, non-asbestos, high temperature, bio-soluble, calcium-magnesium-silicate (CMS) non-woven blanket, encapsulated in a scrim-reinforced foil, blanket thickness of 1.5 inches for ventilation and grease duct applications.. Two 1-1/2" thick layers shall be applied directly to grease and air ducts to provide a 2-hour fire rating. Utilize filament tape and aluminum foil tape, carbon steel or stainless steel banding material, bulk mineral wool, silicone sealant and copper coated steel insulation pins as recommended and provided by the insulation manufacturer for the specific installation.

B. Conforming to NFPA 96, ISO 6944, ASTM C-518, C-1338, E-84, E-119, E-136, E-2336 and E-814.

C. Acceptable Manufacturers: Minnesota Mining Manufacturing (3M), Nelson, Premier, Unifrax.

2.7 TYPE FPC INSULATION:

A. Fiberglass Pipe Covering, 0.23 K factor at 75 F., molded in cylindrical form to fit pipe snugly, sectional one-piece construction, with factory applied flame resistant vapor barrier jacket with double self-sealing flap.

B. Conforming to FS HH-I-558B Form D, Type 3, Class 12 and ASTM C547.

2.8 PIPE INSULATION SADDLES:

A. Provide 180 degree, 16 gauge galvanized steel protection saddle, 12 inches long, at individual pipe hanger support locations.

B. Provide 360 degree, 16 gauge galvanized steel protection saddle, 12 inches long, at each pipe which is clamped to a trapeze hanger.

2.9 HANGER SHIELDS:

A. Provide penetration shields to encase insulated pipes penetrating fire walls or floors in a 360 degree, 24 gage minimum sheet metal hanger shield with insert of high density, 100 psi, waterproofed calcium silicate the same thickness as insulation and further enclosed within the sleeve, sized for maximum 1-inch spacing between sleeve and insulation shield. Pack annular space between sleeve and shield as specified under "Fire-Stopping" in the Section 23 01 00. Install an escutcheon plate to completely cover the wall penetration opening and fit snugly over the pipe insulation shield. Insert shall extend at least 1-inch beyond penetrated surface and escutcheon.

2.10 ADHESIVES, MASTICS AND SEALANTS:

A. Utilize materials recommended by insulation manufacturer for the application.

B. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

2.11 PIPE INSULATION FITTINGS:

A. Fittings shall be premolded of the same material and thickness as the pipe covering and provided with a matching vaporproof barrier, or build up the fittings from segments of pipe insulation or fibrous glass blanket to the proper thickness and then finish with fire retardant tape and vaporproof barrier. Fittings so covered shall be finished with a fire retardant covering to form a smooth, neat appearance similar to that on the straight length of pipe.

B. Valves, strainers, expansion tanks, and similar appurtenances shall be insulated as specified for fittings except that valve bonnets and strainer cleanouts need not be insulated.

C. One-piece premolded PVC fitting and valve covers may be provided in lieu of fitting jacketing specified.

D. Where Type ASJ jacketing is specified, one-piece premolded PVC fitting and valve covers may be provided in lieu of fitting jacketing specified.

PART 3 - EXECUTION

3.1 VAPOR SEALED PIPE INSULATION APPLICATION:

A. Apply insulation only to clean dry pipe after it has been thoroughly tested. Each section of insulation shall be firmly butted together with the end surface of a section of covering having the entire surface buttered with vapor barrier cement and the adjacent end surface of the next section of covering pushed tight to this mastic and vapor sealed.

B. In areas subject to physical abuse, such as gymnasiums, and when recommended by insulation manufacturer, apply outwardly clinched staples, minimum three per length of insulation. Seal all staple locations with white vapor barrier cement.

C. At points where pipe hangers occur, insulation damage shall be prevented.

3.2 DOMESTIC COLD AND HOT WATER PIPING:

A. Insulate in their entirety except do not insulate 1/2-inch and smaller branches in pipe chases serving single fixtures or horizontal stubouts directly to fixtures from pipe chases or chrome plated pipe.

B. Insulate hot and cold water and waste piping beneath handicapped sinks. Provide manufactured piping covers consisting of flexible vinyl insulation with white finish and access to piping, equivalent to Handi Lav-Guard manufactured by Truebro, Inc.

C. Utilize PFP insulation for hot water below grade, FPC insulation for cold and hot water above grade.

3.3 COLD DRAIN PIPING:

A. Insulate condensate drain piping completely from the unit drain pan to the point of connection to the sanitary waste system.

1. Exception - Condensate drain piping inside of mechanical rooms does not require insulation.

B. Cold Condensate or Electric Water Cooler Drains – Insulate sanitary waste above grade from drain receiving cold liquid to point of connection to vertical stack or sanitary waste affording dilution adequate to preclude condensation on uninsulated pipe, including "P" trap and vertical piping down to the first elbow.

C. Rain Water Drain Piping - Insulate only those portions of the downspouts above grade which run horizontally, including the elbow turned down and the elbow turned up, to and including portions of the roof drains below the roof and vertical piping down through the first elbow.

3.4 DUCT INSULATION:

A. Insulate ductwork as scheduled in this Section. Material shall be as specified for each insulation class.

B. Provide access door insulation so that doors can be opened without damaging insulation.

C. Install type FBW insulation in strict accordance with the manufacturer's recommended installation procedure for grease and air duct for zero clearance to combustibles and 2-hour rated duct enclosure. The completed installation shall be in accordance with the product's UL listed assembly.

D. Do not insulate preinsulated ductwork or flexible runouts.

3.5 DUCT LINER:

A. Fabrication and installation shall conform to manufacturer’s recommendations and to the requirements of the latest edition of the North American Insulation Manufacturers Association's *Fibrous Glass Duct Liner Standard*, or of the Sheet Metal and Air Conditioning Contractors National Association *HVAC Duct Construction Standards - Metal and Flexible*) or the manufactures recommendations.

B. 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 black surface treatment exposed to the air stream.

C. Duct liner shall be adhered to the sheet metal with 90% (minimum) coverage of adhesive complying with the requirements of ASTM C 916.

D. 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.

E. 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 shall be weld-secured, shall be installed perpendicular to the duct surface and shall penetrate to the outside of ducts.. 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.

F. 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.

G. 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.

H. 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

I. 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

J. 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

K. Field Quality Control

1. 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.
2. 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:
3. Check all registers, grilles, and diffusers to ensure that they are clean and free from construction debris.
4. Check all filters in accordance with their manufacturer's instructions. Use specified grade of filters at all times that system is operating.
5. Cover supply openings with filter media prior to system start-up to catch any loose material that may remain inside the ductwork.
6. Turn the HVAC system on and allow it to run until steady state operation is reached.
7. Remove the temporary filter media from supply openings and, along with it, any loose material blown downstream and caught by the filter media.

L. Protection

1. Contractor’ 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.
2. 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.

3.6 DUCT INSULATION SCHEDULE:

Note: All ductwork shall be either insulated or lined unless specifically noted otherwise below or on plans.

		TYPE	THICKNESS (Inches)
A.	Rectangular Supply Duct Inside Building	FDL	½
B.	Rectangular Return Duct Inside Building	FDL	½
C.	Round Supply Duct	FDB	1 ½
D.	Rectangular Exhaust Duct	FDL	1/2
E.	Round Exhaust Duct	---	---
F.	Kitchen Range Hood Exhaust Duct		
	1. Where enclosed with 2 hour fire-rated construction by G.C.	---	---
	2. Where not enclosed with 2 hour fire-rated construction by G.C.	FBW	3
G.	Dishwasher Exhaust Duct	---	---

3.7 PIPE INSULATION SCHEDULE:

	PIPE SIZE (Inches)	INSULATION TYPE	THICKNESS (Inches)	JACKET TYPE
A. Domestic cold and hot water (PEX) in exterior walls, on room side of insulation	All	PFP	1	---
B. Domestic cold water above grade	All	FPC	½	ASJ*
C. Domestic cold water below grade	All	---	---	---
D. Domestic hot water & recirculating above grade	All	FPC	1	ASJ*
E. Domestic hot water & recirculating below grade	All	PFP	1	---
F. Condensate drain piping	All	FPC	1	ASJ*
G. Heating Water Supply and Return	Under 1	FPC	½	ASJ*
	1 & Over	FPC	1	ASJ*
	Under 4	FPC	1	ASJ*
H. Chilled Water Supply and Return Piping				
	4 & Over	FPC	1 1/2	ASJ*

	PIPE SIZE (Inches)	INSULATION TYPE	THICKNESS (Inches)	JACKET TYPE
H. Domestic cold water above grade	All	FPC	½	ASJ*
I. Domestic cold water below grade	All	---	---	---
J. Domestic hot water & recirculating above grade	All	FPC	1	ASJ*
K. Domestic hot water & reciculating below grade	All	PFP	1	---
L. Condensate drain piping	All	FPC	1	PVC

*Apply PVC jacket to all insulated piping installed exposed in rooms, except in mechanical rooms.

END OF SECTION 23 25 00

SECTION 236000 - HEATING EQUIPMENT

PART 1 - PART 1 - GENERAL

1.1 WORK INCLUDED:

A. This Section includes equipment used for heating throughout the Project.

1.2 SUBMITTALS:

A. Submit complete printed catalog and descriptive data for each piece of equipment, clearly indicating what features, options and accessories are being provided.

B. See Section 23 01 00.

PART 2 - PRODUCTS

2.1 OPEN COIL ELECTRIC DUCT HEATER:

A. Approvals - Heaters and controls shall meet the requirements of the National Electrical Code and shall be listed by Underwriters Laboratories for zero spacing between the duct and combustible surfaces and for use with heat pumps and air conditioning equipment.

B. Heating elements shall be open coil, 80% nickel, 20% chromium, Grade A resistance wire. Type C alloys containing iron or other alloys are not acceptable. Coils shall be machine crimped into stainless steel terminals extending at least 1" into the airstream and all terminal hardware shall be stainless steel. Coils shall be supported by ceramic bushings staked into supporting brackets.

C. Heater frames and terminal boxes shall be corrosion resistant steel. Unless otherwise indicated, the terminal box shall be NEMA 1 construction and shall be provided with a hinged, latching cover and multiple concentric knockouts for field wiring.

D. All heaters shall be furnished with a disc type, automatic reset thermal cutout for primary over temperature protection. All heaters shall also be furnished with disc type, load-carrying manual reset thermal cutouts, factory wired in series with heater stages for secondary protection. Heat limiters or other fusible over temperature devices are not acceptable.

E. Heaters shall be rated for the voltage, phase and number of heating stages indicated in the schedule. All three-phase heaters shall have equal, balanced, three-phase stages. All internal wiring shall be stranded copper with 105°C insulation and shall be terminated in crimped connectors or box lugs.

F. Terminal blocks shall be provided for all field wiring and shall be sized for installation of 75°C copper wire rated in accordance with NEC requirements.

G. Heaters shall be furnished with a SCR power controller to modulate the entire heater load, varying the heater output from 0 to 100% of the total heater KW. Working on a one second time base, the heater shall be energized only for the number of AC cycles necessary to produce the exact amount of heat required.

H. Acceptable Manufacturers – Brasch, Indeeco, Thermolec.

PART 3 - EXECUTION

3.1 MANUFACTURER'S DIRECTIONS:

A. Install equipment in strict accordance with manufacturer's recommendations and of other sections of the Specifications.

3.2 SPACE REQUIREMENTS:

A. The Contractor shall coordinate the installation of heating equipment to ensure that the manufacturer’s recommended clearances and service access requirements are met.

END OF SECTION 23 60 00

SECTION 23 65 75 – PACKAGED MAKE-UP AIR UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Provide labor and equipment, materials and transportation to receive, install and put into operation roof top air conditioning equipment as specified, scheduled, shown, or detailed in the Project Documents.

B. This Contractor shall be responsible for the complete installation of the control systems for all roof top heating/cooling units specified herein, including all wiring, thermostats and ancillary equipment necessary to provide a complete and fully operative control system as specified or scheduled. Where required by applicable codes, this contractor shall provide the services of a licensed electrician to complete this work. Where indicated on plans, the electrical contractor will provide a empty box and conduit for the thermostat and controls wiring.

1.2 SUBMITTAL DATA:

A. Submit complete printed catalog and descriptive data for each major piece of equipment. Include:
   1. Equipment, piping and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections
   2. Piping, valves and fittings shipped loose showing final location in assembly
   3. Control equipment shipped loose, showing final location in assembly
   4. Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads
   5. Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers
   6. Fan performance curves
   7. Details of vibration isolation
   8. Estimate of sound levels to be expected across individual octave bands in db
   9. Type of refrigerant used
   10. Plan view, front view end view, back view and curb detail with dimensions
   11. 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. Manufacturer’s Instructions: Manufacturer’s installation instructions
   12. Manufacturer’s Field Reports: Manufacturer’s field reports specified herein
   13. Closeout Submittals: Submit the following:

a. Warranty: Warranty documents specified herein
b. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance. Include names and addresses of spare part suppliers
c. Provide brief description of unit, with details of function, operation, control and component service
d. Provide equipment inspection report and equipment operation test report

B. See Section 23 01 00.

1.3 REFRIGERANT AND OIL:

A. Furnish an adequate supply of refrigerant and oil, and maintain refrigerant and oil in the system in proper quantities for one year warranty period from the date of acceptance by the Owner. Any source of leakage necessitating addition of refrigerant or oil during warranty period shall be found and corrected.

B. Refrigerant or oil lost or contaminated during the warranty period shall be provided without additional charge for both labor and material.

1.4 WARRANTY:

A. Refrigeration compressors shall be warranted for five years.

B. Aluminized steel heat exchanger furnace shall carry a 15 year non-prorated warranty.

C. All other unit components shall be warranted for one year.

PART 2 - PRODUCTS

2.1 MAKE-UP AIR UNITS:

A. One-piece, air-to-air, factory assembled, precharged, piped, and wired packaged unit. The manufacturer shall test operate unit at the factory prior to shipment.

B. Provide leakproof, insulated roof mounting curb approved by the National Roofing Contractor's Association, with built-in cant strip and flashing constructed of 14 gage minimum thickness galvanized steel, 14-inch minimum height, designed to form a waterproof assembly when the unit is installed. Curb shall be full perimeter design with all service connections within the curb area, "structural" type, arranged to span between supports. Top surface shall be level (provide pitched curb when installed on pitched roof). Coordinate roof curb with roof type and slope to ensure compatibility. Provide adaptor curb where required to mount new unit on existing curb.

C. Construction

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D-1929 for a minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents moisture accumulation on the insulation, provides a cleanable interior, prevents heat transfer through the panel, and prevents exterior condensation on the panel.
4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRI Standard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpoint of the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Electrical conduit through cabinet panels shall include sealing to reduce air leakage.
5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers, heaters, and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.

D. Compressor(s) shall be hermetic scroll type, with crankcase heater, vibration isolation, and filter drier(s). Motor compressor units shall be warranted for five years.
1. Compressors shall be refrigerant cooled, resiliently mounted on rubber mounts for vibration isolation, and isolated from condenser and evaporator fan air streams
2. Refrigerant shall be 410A.
3. Units with a nominal capacity of 7.5 tons and greater shall be provided with multiple compressors and a separate refrigerant circuit for each compressor.

E. Coils:
1. Evaporator Coils and hot gas reheat coils shall be aluminum plate fins mechanically bonded to copper tubes, with balanced port thermal expansion valves, freeze protection on each circuit, pressure and leak tested to 500 psi.
2. Condenser coils shall be aluminum lanced fins thermally bonded to aluminum flat tube.

F. Supply Fans
1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balanced and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
4. Provide factory mounted and installed variable speed drive.

G. Outdoor air fans shall be direct drive propeller type, with inherent motor protection. See Section 23 01 00 for motors.

H. Units with gas heat shall have a redundant gas valve to achieve 100% pilot shutoff when there is no call for heat as well as the standard gas valve for controlling the main burner, automatic spark ignition system, limit switch, flame rollout switch, induced draft fan and draft failure switch.

I. Gas burners shall be aluminized steel. Multicell heat exchangers shall be heavy gage steel. Heat exchangers shall have a 15-year warranty.

J. Units shall contain the following safety controls-
1. Low and high pressure cutouts on each circuit.
2. TXV with removable element head on each circuit.
3. Modulating hot-gas reheat control valve.
4. Crankcase heater on each compressor.
5. Compressor motor overloads.
6. Timer to limit compressor starts to not more than one each 5 minutes (adjustable).
7. Low ambient control to allow compressor operation to 40°F and to prevent compressor operation below 40°F (adjustable) outside air temperature.

K. Units shall be factory wired for single point electrical connection.

L. On units 2,000 to 15,000 cfm, Install a UL approved smoke detector, provided by the electrical contractor or by the unit manufacturer as scheduled, and installed by the mechanical contractor in the return air path, arranged to shut down the unit fan(s) upon detection of smoke. Coordinate installation of the remote test switch, and interface with building fire alarm system, as applicable, with electrical contractor.

M. Unit shall be arranged to shut down the unit fan(s) upon activation of kitchen hood fire suppression system. Coordinate installation with electrical contractor.

N. Air Filters -
1. Make-up Air Units shall be provided from factory with 2" thick filter frames.
2. Provide temporary filter elements in the filter banks of supply systems used during construction prior to using the system.
3. Temporary filter elements may be either throw-away type with frames taped air-tight or as scheduled for the system.
4. Immediately prior to test and balance operations, replace temporary filters with a new set of scheduled filter elements.
5. After final acceptance, a new set of scheduled filter elements shall either be delivered to Owner or installed to replace "test" filters, as directed by Owner.
6. Filter Elements - Type MEPM - medium efficiency pleated media - 2-inch thick disposable type of pre-formed pleated, non-woven, cotton fabric media continuously laminated to a supporting steel wire grid conforming to the configuration of the pleat, sealed in a chip board media frame, minimum 25 percent average NBS efficiency with atmospheric dust. Maximum 0.38-inches WC initial resistance at 500 fpm face velocity. Minimum MERV 7.

O. Provide each unit with a low leakage, motorized spring return damper.

P. When scheduled, provide units with:
   1. Modulating hot gas reheat capability. Furnish zone humidity sensor with unit.
   2. Additional features as scheduled.

Q. Provide units with factory mounted and wired non-fused power disconnect switch, and factory mounted and wired ground fault interrupting, weatherproof power receptacle with in-use cover. Receptacle shall remain energized when disconnect is turned off.

R. Controls:
   1. Factory Installed and Factory Provided Controller
      a. Unit controller shall be capable of controlling all features and options of the unit. Controller shall be factory installed in the unit controls compartment and factory tested.
      b. Controller shall be capable of stand-alone operation with unit configuration, setpoint adjustment, sensor status viewing, unit alarm viewing, and occupancy scheduling available without dependence on a building management system.
      c. Controller shall have an onboard clock and calendar functions that allow for occupancy scheduling.
      d. Controller shall include non-volatile memory to retain all programmed values, without the use of an external battery, in the event of a power failure.
      e. Provide wall mounted touch screen interface where scheduled.
      f. With the modulating hot gas reheat option a space humidity sensor and supply air temperature sensor shall be furnished with the unit for field installation. Suction pressure sensor shall be factory installed. Supply air temperature and space humidity setpoints, for the dehumidification mode of operation, shall be adjustable.
      g. Outside air temperature sensor shall be factory mounted and wired. Supply air temperature sensor shall be furnished with the unit for field installation.
      h. Shall accept input from a differential pressure sensor
      i. 2-stage or modulating heat, as scheduled/number of cooling stages as scheduled.
      j. Indoor air quality input
      k. Provide terminal strip and isolation relays for interface of Building Controls and Kitchen Hood Controls.
   2. Room sensors.
   3. Provide additional control accessories where scheduled or where required for the installation.

S. Control Sequences:
   1. Start/Stop
      a. MAU-F1 shall start upon signal from kitchen hood control panel.
      b. MAU-F2 shall start upon signal from the Building Control System.
   2. Heating: Reset the discharge air temperature to maintain the space temperature setpoint. Space temperature setpoint provided from the Building Control System.
   3. Cooling: Reset the discharge air temperature to maintain the space temperature setpoint. Space temperature setpoint provided from the Building Control System.
   4. Ventilation:
      a. MAU-F1 provide 100% outside air at constant volume scheduled.
      b. MAU-F2 provide 100% outside air. Modulate volume to maintain room pressurization of 0.05” w.c. relative to outside.
   5. Dehumidification: Modulate cooling coil and reheat coil to maintain space humidity setpoint while maintaining space temperature setpoint.

T. Acceptable Manufacturers: Aaon, Carrier, Daiken, Greenheck, Lennox, Trane Horizon, Valent, York.

PART 3 - EXECUTION

3.1 MANUFACTURER'S DIRECTIONS:

A. Install equipment in strict accordance with manufacturer's recommendations and requirements of other Sections.

3.2 COORDINATION:

A. Units installed on roof:
   1. Roof decking shall remain inside of curb except for openings required for duct, controls and electrical power penetrations. Coordinate roof deck installation and cutting of openings with General Contractor. Pack annular space around duct and conduit penetrations with fiberglass insulation.
   2. Coordinate responsibility for providing equipment roof curbs and flashings with roofing contractor. Coordinate curb type with roofing contractor to ensure curb's compatibility with roofing system and with curb-mounted equipment.
   3. Coordinate electrical installation with electrical contractor so that all required conduit roof penetrations occur within the unit curb.

B. Units installed on grade:
   1. Coordinate concrete slab installation with General Contractor.
   2. Install roof curb level and secured to concrete slab.
   3. Provide sheet metal shroud as detailed on drawings, for all ductwork exposed outside of the building.

C. Electrical Connections:
   1. Coordinate with other trades the complete electrical installation for all necessary final power and controls connections to equipment and loose shipped electrical components.
   2. For rooftop installation, coordinate electrical installation with electrical contractor so that all required conduit roof penetrations occur within the unit curb.

3.3 DELIVERY, STORAGE AND HANDLING:

A. Handle units and components carefully to prevent damage. Replace damaged units or components with new.

B. Store units and components in clean dry place, off the ground and protect from weather, water, and physical damage.

C. Rig units to comply with manufacturer's rigging and installation instructions for unloading units and moving them to final location.

3.4 EXAMINATION:

A. Examine areas and conditions under which units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.5 INSTALLATION:

A. General: Install units in accordance with manufacturer's installation instruction. Install units plumb and level, firmly anchored in locations indicated and maintain manufacturer's recommended clearances.

3.6 DEMONSTRATION:

A. Start-up Services: Provide the services of a factory authorized service representative to start-up units, in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

3.7 TESTING AND BALANCING:

A. See Section 23 99 00.

3.8 SYSTEM VERIFICATION AND CALIBRATION:

A. Make all repairs, adjustments and programming changes necessary to accomplish the desired operation of the HVAC systems.

B. See MECHANICAL SYSTEM VERIFICATION AND CALIBRATION of Specification Section 23 01 00 for complete requirements.

END OF SECTION 23 65 75

SECTION 23 80 00 - HVAC EQUIPMENT - AIR SIDE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air-side heating, ventilating and air handling equipment of all types employed in the Project.

1.2 EQUIPMENT IDENTIFICATION

A. Each piece of equipment shall bear a manufacturer's identification label which clearly lists the manufacturer's name, the model number, and a unique serial number.

1.3 SUBMITTALS

A. Submit complete printed catalog and descriptive data for each major piece of equipment, clearly indicating exactly what features, options and accessories are being provided.

B. Submit unit performance including: capacity, nominal and operating performance.

C. Submit Mechanical Specifications for unit and accessories describing construction, components and options.

D. Submit shop drawings indicating overall dimensions as well as installation, operation and service clearances. Indicate lift points and recommendations. Indicate unit shipping split locations, and split dimensions, installation and operating weights including dimensions.

E. Submit data on electrical requirements. Include safety and start-up instructions.

F. See Section 23 01 00.

PART 2 - PRODUCTS:

2.1 HORIZONTAL AND VERTICAL FAN COIL UNITS

A. Provide fan coil units as scheduled. Units shall be certified to deliver published heating or cooling capacities when tested in accordance with ARI Standard 440-89. Power input shall not exceed values shown in schedule. Units shall be complete with two water coils, one or more centrifugal fans, filters, condensate drain pan, galvanized steel casing panels, filter holding frames, 1-inch Type TA filters, controls and valves as described below.

B. Water coils: provide two coils for 4-pipe units, as scheduled. Maximum air velocity through active coil area shall not exceed 500 FPM. Air seal shall be provided to prevent air bypassing the coil(s).

1. Cooling coils shall be 1/2" O.D. copper tubes mechanically bonded to aluminum plate fins. The entire assembly shall be factory tested with 300 PSIG air pressure when the coil is submerged in warm water. The coil shall have a maximum working pressure of 200 PSIG. Auxiliary heating coil (when scheduled) shall be the same as cooling coils, except with 1/2" O.D. tubes. Each coil shall be provided with a manual air vent and drain valve.
2. Auxiliary heating coil shall be constructed of ½" O.D. seamless copper tubes mechanical bonded to aluminum fins. The coils shall be tested at 300 PSIG air pressure under warm water, and shall have a maximum working pressure of 200 PSIG. Each coil shall be provided with a manual air vent.
3. Provide factory installed and tested piping package consisting of supply and return stops, test plugs, strainer, unions, manual air vent, control devices, and balancing devices.

    a. Cooling coil control device: 3-way mixing control valve.
    b. Heating coil control devices: 3-way mixing control valve.
    c. See Sections 230100 and 230500 for individual component specifications.

C. Controls:

1. The remote thermostat/controller will be provided by Johnson Controls, Inc. and will be field mounted and wired. Unit shall be furnished with a terminal block for field terminations.
2. Each unit shall be supplied with an electric junction box and shall be completely factory wired in accordance with UL and the National Electric Code, for a single point of electrical connection at the junction box. A non-fused toggle disconnect switch shall be factory mounted and wired. Exposed wiring shall be in flexible conduit.

D. Fan Section:

1. Fans shall meet the scheduled airflow, static pressure and brake horsepower performance. Fan assemblies shall be designed for industrial applications.
2. Each unit shall be supplied with a multi-tap, high efficiency, permanent split capacitor type motor with UL listed automatic reset thermal overload protection. Motor and fan(s) assembly shall be easily removable for servicing away from the unit. Fans shall be dynamically balanced. Fan housing shall be constructed of galvanized steel with streamlined air inlets.

E. Condensate drain pan:

1. Shall be 16 gauge 304 stainless steel, insulated and pitched with unit level. Pan shall project under the entire length and width of coil, including headers and return bends.
2. An auxiliary plastic drain pan shall be mechanically fastened to unit and shall extend completely under the piping package components.

F. Cabinet Construction:

1. Vertical unit cabinets shall be constructed of 14 gauge galvanized steel. Front and discharge panels shall be insulated with 1/2" thick, 2 pound density, foil faced fiberglass. Vertical model front panels shall be one piece, secured to unit with heavy duty concealed fasteners for tool-less removal and installation.

2. Horizontal unit cabinets shall be constructed of 18 gauge galvanized steel insulated with 1/2" thick, 2 pound density, foil faced fiberglass.
3. Recessed horizontal units shall have telescoping bottom access panel with a continuous hinge along the width of the unit, integral stamped return air grille, and tamper-proof fasteners.
4. Ducted units shall be provided with duct flanges. Non- ducted units shall be provided with stamped discharge grilles.
5. Cabinets shall have 9-inch minimum width end pocket extension on valve side. Vertical model top panels shall be provided with two die-formed flush access doors with a continuous hinge on one side, full perimeter support on the other three sides, and a tamper proof latch.
6. Visible cabinet parts shall be cleaned and phosphatized before powder coating in light beige finish.
7. For vertical units, tops shall be sloped, and filters shall be removable without removing front access door.

G. For suspended units, provide vibration isolators equivalent to Mason model HD. Isolator shall be an elastomeric hanger, consisting of a rectangular steel box and an elastomeric isolation element, which shall be of neoprene or high quality synthetic rubber with ozone additive. The elements shall be designed for minimum 0.25-inch total static deflection under load, and loaded so that deflection does not exceed 15 percent of the free height of the element. The design shall be such as to prevent metal-to- metal contact between the hanger rod and the steel box. Units with greater than 0.25-inch deflection shall be provided with spring isolators.

H. Filters - Units shall have a filter rack to accept a 1" thick filter. See below for filters.

I. Acceptable Manufacturers – Carrier, JCI (York), Trane, Daiken..

2.2 BLOWER COIL UNITS (LESS THAN 5,000 CFM)

A. General Unit Description – Provide blower coil units as scheduled. Indoor mounted central station unit designed to provide air to a conditioned space as required to meet specified performance requirements for ventilation, heating, cooling, filtration and distribution. Unit shall be arranged to discharge conditioned air horizontally or vertically as shown on the contract drawings. All units shall be capable of meeting or exceeding the scheduled capacities for cooling, heating and air delivery. All unit dimensions for each model and size shall be considered maximums.

B. Quality Assurance:

1. Unit performance shall be rated in accordance with AHRI (Air-Conditioning, Heating and Refrigeration Institute) Standard 430 for Central Station Air-Handling Units and subject to verification of rating accuracy by AHRI-sponsored, third party testing.
2. Coils shall be certified in accordance with AHRI Standard 410, latest edition.
3. Insulation and insulation adhesive shall comply with NFPA (National Fire Protection Association) 90A requirements for flame spread and smoke generation.
4. The management system governing the manufacture of this product is ISO 9001:2008 certified.
5. Unit shall be constructed in accordance with ETL standards and shall carry the ETL label.

C. Cabinet Construction:

1. Unit shall be a factory-assembled, single-piece central station air handler. Unit may consist of a fan and coil section with factory-installed chilled water or direct expansion coil, preheat or reheat coil, heating coil section, filter section, mixing box or combination filter/mixing box, or access section as indicated on the equipment schedules. Unit base rail shall be 14 gage galvanized steel.
2. Unit panels shall be constructed of 20 gage galvanized steel. Casing panels shall be removable for easy access to the unit. All panels shall be gasketed to ensure a tight seal.
3. Hinged access doors shall be double wall with 1.5 lb dual-density fiberglass between galvanized steel panels.
4. Insulation for casing panels on unit shall be 1-in. minimum thickness dual-density fiberglass insulation with a nominal density of not less than 1.5 lb per cubic foot.
5. Insulation shall be secured to casing with waterproof adhesive.
6. Condensate drain pans shall be sloped to prevent standing water and constructed of stainless steel; they shall have double wall construction with threaded drain connection.

D. Fan Section:

1. Fan sections shall be constructed of galvanized steel and shall have a formed channel base for integral mounting of fan, motor, and casing panels. Fan scroll, wheel, shaft, and bearings are to be rigidly secured to the base unit.
2. Each unit shall have a single fan wheel and scroll. Fans shall be double width, double inlet type, with forward-curved blades. Wheels shall be bonderized steel with baked enamel, or galvanized steel.
3. Fan wheels shall be keyed to the shaft and shall be designed for continuous operation at the maximum rated fan speed and motor horsepower. Fan wheels and shafts shall be selected to operate at least 25% below the first critical speed, and shall be statically and dynamically balanced as an assembly.
4. Fan shafts shall be solid steel, turned, ground and polished.
5. Fan bearings shall be self-aligning, pillow-block regreasable ball type selected for an average life of 200,000 hours at design operation conditions, per ANSI Code B3.15.
6. Fan motor shall be mounted within the fan section casing on slide rails having 2 adjusting screws. Motor shall be NEMA (National Electrical Manufacturing Association) Design B with sizes and electrical characteristics as shown on the equipment schedule.
7. Fan drive shall be designed for a 1.5 service factor and shall be factory mounted and aligned. Belt drive shall be variable or fixed-pitch type.
8. Fan electrical control shall be completely factory wired to include motor circuit fusing, contactor, field wiring terminal strip, disconnect switch, and single point power connection.

E. Coil Sections:

1. All coils shall have mill galvanized casings. Coils shall be factory leak tested at 450 psig air pressure.
2. Chilled water coils shall have aluminum plate fins with belled collars bonded to 1/2-in. minimum OD copper tubes by mechanical expansion. Coils shall have galvanized steel casings and copper headers with threaded steel pipe connections. Working pressure shall be 300 psig at 200 F. Coils shall be drainable and have non-trapping circuits. No turbulence- promoting devices will be permitted inside the tubes. Headers shall have drain and vent connections.

3. Hot water coils shall have aluminum plate fins with belled collars bonded to copper tubes by mechanical expansion. Coils shall have galvanized steel casings and copper headers with threaded steel pipe connections. Working pressure shall be 175 psig at 400 F. Headers shall have drain and vent connections.

F. Filter Sections:

1. Each filter section shall be designed and constructed to house the specific type of filter specified on the equipment schedule.
2. Angle filter section shall accept 2-in. filters arranged in horizontal V formation. Double-walled hinged doors shall be provided.

G. For suspended units, provide vibration isolators equivalent to Mason model HD. Isolator shall be an elastomeric hanger, consisting of a rectangular steel box and an elastomeric isolation element, which shall be of neoprene or high quality synthetic rubber with ozone additive. The elements shall be designed for minimum 1-inch total static deflection under load, and loaded so that deflection does not exceed 15 percent of the free height of the element. The design shall be such as to prevent metal-to- metal contact between the hanger rod and the steel box.

H. Acceptable Manufacturers – Carrier, JCI (York), Trane, Daiken.

2.3 AIR FILTERS

A. Provide filters of type, size and model scheduled.

B. Provide temporary filter elements in the filter banks of supply systems used during construction prior to using the system.

C. Temporary filter elements may be either throw-away type with frames taped air-tight or as scheduled for the system.

D. Immediately prior to test and balance operations, replace temporary filters with a new set of scheduled filter elements.

E. After final acceptance, a new set of scheduled filter elements shall either be delivered to Owner or installed to replace "test" filters, as directed by Owner.

F. Stationary Holding Frames:

1. Provided with packaged equipment.

G. Filter Elements:

1. Type TA1 - throw-away filter - fiberglass media contained in rigid media frame with a supporting maze across both entering and leaving faces of media. 1-inch thick disposable type, with a rated average dust-spot efficiency of 35-percent (MERV 7 rating) when tested in accordance with ASHRAE Standard 52.2, nonwoven fabric, treated with adhesive and continuously laminated to a supported steel-wire grid.MERV-7 fiberglass filters.

a. Provide 1-inch thick TA1 filters for fan coil units.

2. Type TA2 – throw away filter - medium efficiency pleated media - 2-inch thick disposable type, with a rated average dust-spot efficiency of 35-percent (MERV 7 rating) when tested in accordance with ASHRAE Standard 52.2, nonwoven fabric, treated with adhesive and continuously laminated to a supported steel-wire grid.MERV-7 fiberglass filters.

a. Provide 2-inch thick TA2 filters for blower coil units.

H. Acceptable Manufacturers - American Air Filter, Cambridge, Continental, Farr.

2.4 ROOF CAPS:

A. Factory fabricated low silhouette type units, with hood, pedestal and curb mounting base with counterflashing, all fabricated of heavy gage galvanized or aluminum sheet, reinforced with a welded steel frame, finished with 1/2-inch mesh hardware cloth birdscreen at openings. Roof cap shall be rectangular or round in shape, with bottom or side louvered openings, as scheduled.

B. Units shall be finished with a zinc chromate primer and a rubber base or acrylic enamel finish.

C. Underside of hood shall have bitumastic anti condensate coating.

D. Provide with insulated roof curb and gravity backdraft damper. Curb shall be a minimum of 12 inches high, and shall be pitched when installed on sloping roofs to result in a level top of curb.

E. Acceptable Manufactures - Acme, Carnes, Cook, Greenheck, Jenn-Air, Penn, Nailor, Twin City.

2.5 LOUVERS (FIXED)

A. Louvers equivalent to Greenheck model ESD-435 drainable type, fabricated from 6063-T5 aluminum extrusions of 0.081 in nominal wall thickness. Blades shall be positioned at 37.5 deg angles approximately on 3 1/4 in centers. Each louver shall be equipped with a framed, removable, rear-mounted screen of 0.75 in x 0.051 in expanded, flattened aluminum birdscreen.

B. Louvers shall be stationary type with drainable blades in a 4 in louver frame. Each stationary blade shall incorporate an integral drain gutter and each jamb shall incorporate an integral downspout so water drains to blade end} then down the downspouts and out at the louver sill rather than cascading from blade to blade.

C. Each factory-assembled louver section shall be designed to withstand wind loadings of 25 PSF (100.0 MPH wind equivalent). Louver frames, mullions, and section joints shall be adequately supported from the building structure to withstand this same wind loading.

D. Louver performance data shall be licensed under the AMCA Certified Ratings Program. and shall bear the AMCA Certified Ratings Seal. This certified performance data shall include airflow pressure loss and water penetration, and shall demonstrate performance equal to or better than the Greenheck model specified.

E. Louvers shall be supplied with a baked enamel finish applied after a thorough cleaning and preparation of the metal surface. A total dry film thickness of approximately 1.2 mils shall be provided. Color shall be as selected by the Architect from standard color chart.

F. Provide insulated (2-inch thick) metal blank-off panel(s) for all louvers. Provide open area for all areas noted as active on drawings.

G. Acceptable Manufacturers: Air Balance, American Warming & Ventilating, Carnes, Greenheck, Ruskin.

2.6 PACKAGED CEILING FANS:

A. Packaged ceiling fans shall be factory assembled units including fan, motor, housing, prewired plug disconnect and discharge damper with capacities, arrangements and accessories as scheduled. Provide intake grille when installed in ceiling.

B. Fan wheels shall be of the centrifugal type, direct connected to a permanently lubricated, radio shielded, thermally protected motor with neoprene torsion mounts to isolate vibration.

C. Fan and motor shall be enclosed in a baked enamel steel housing suitable for horizontal or vertical discharge and ceiling or in-line installation. Housing shall be lined with 1/2-inch acoustical insulation.

D. Intake grille (where required) shall be white aluminum or plastic and shall be removable for cleaning or service.

E. Furnish necessary ductwork, transitions, eaves, wall or roof caps as scheduled and as required.

F. Acceptable Manufacturers, - Acme, Carnes, Cook, Greenheck, Loren Cook, Penn.

2.7 CENTRIFUGAL UP-BLAST ROOFTOP EXHAUST FANS:

A. Exhaust fans shall be centrifugal wheel, upblast roof ventilators, capacities, sizes, types, and accessories as scheduled.

B. Each fan shall be selected to operate quietly and efficiently on its volume-pressure curve, free from objectionable vibration, and shall carry the certified rating seal authorized by AMCA at the scheduled ratings.

C. Square curb base and throat section shall be constructed in one piece, on not less than 12 gage aluminum, with the throat section spun to provide streamlined entrance to the fan wheel. Fan wheel shall be centrifugal, backwardly inclined, non- overloading type, constructed of not less than 12 gage aluminum for blades and bottom inlet of wheel and 1/8-inch aluminum for the top plate.

D. The fan shall have an upblast arrangement on the discharge with complete grease and condensate drainage. Motor and drive compartment shall be separated from the air stream. Air for cooling the motor shall be supplied to the internal motor compartment through a vent tube from a location free of discharge contaminants.

E. Outer baffle and motor compartment hood shall be spun aluminum of not less than 12 gage, designed for sub-assembly and arranged for access to motor-drive compartment and wheel assembly without dismantling unit.

F. Drives for fan wheels shall be direct or V-belt as scheduled.

G. Supporting members of drive assembly shall be constructed of not less than 1/8-inch aluminum, isolated with multi- directional vibration mountings.

H. Where required, bearings shall be flanged type, mounted in rubber, sealed and prelubricated.

I. V-belt drives shall be furnished with variable sheave on the motor.

J. Motor base shall be adjustable.

K. Motors shall be resilient mounted, ball bearing, open type with horsepower, speed and current characteristics as scheduled. See Section 230100 for motors. Furnish with each motor, a factory mounted disconnect switch with motor overload protection suitable for the motor scheduled and factory isolated conduit from the motor compartment to inside the curb cap.

L. Each unit (except kitchen hood exhaust fans) shall be furnished with an easily removable galvanized or polyvinyl coated steel hardware cloth birdscreen and a gravity backdraft damper. Damper shall be constructed of not less than .020 aluminum formed for rigidity and pivoted to an extruded aluminum or heavy rustproofed steel frame with nylon or brass bearings. Blades shall be connected together with pivoted aluminum tie rods.

M. Provide fan manufacturer's prefabricated minimum 24-inch high insulated metal roof curbs constructed of heavy galvanized steel or welded aluminum to match fan construction, full 2-inch thick heavy density internal insulation, rubber curb cap for fan base mounting, factory clips or attachment devices to secure fan tight to curb, counterflashing, wide roof flange, backdraft damper frame, and cant strip. Furnish complete and as recommended by the manufacturer.

N. Acceptable Manufacturers - Acme, Ammerman, Carnes, Greenheck, Loren Cook, Jenn-Air, Penn, Twin City Fans.

2.8 CENTRIFUGAL DOWNBLAST ROOFTOP EXHAUST FANS:

A. Exhaust fans shall be centrifugal wheel, downblast roof ventilators, capacities, sizes, types and accessories as scheduled.

B. Each fan shall be selected to operate quietly and efficiently on its volume-pressure curve, free from objectionable vibration, and shall carry the certified rating seal authorized by AMCA at the scheduled ratings.

C. Square curb base and throat section shall be constructed in one piece, on not less than 12 gage aluminum, with the throat section spun to provide streamlined entrance to the fan wheel. Fan wheel shall be centrifugal, backwardly inclined, non- overloading type, constructed of not less than 12 gage aluminum for blades and bottom inlet of wheel and 1/8-inch aluminum for the top plate.

D. Motor and drive compartment shall be separated from the air stream by a horizontal plate constructed of not less than 1/8- inch aluminum and supported by columns of aluminum round stock or cast brackets.

E. Outer baffle and motor compartment hood shall be removable for service, and shall be one of the following, as scheduled:

1. Spun aluminum of not less than 12 gage.
2. Heavy extruded aluminum louvers with mitered and welded corners.

F. Drives for fan wheels shall be direct or V-belt as scheduled.

G. Supporting members of drive assembly shall be constructed of not less than 1/8-inch aluminum, isolated with multi- directional vibration mountings.

H. Where required, bearings shall be flanged type, mounted in rubber, sealed and prelubricated.

I. V-belt drives shall be furnished with variable sheave on the motor.

J. Motor base shall be adjustable.

K. Motors shall be NEMA standard, resilient mounted, ball bearing, open type with horsepower, speed and current characteristics as scheduled. Furnish with each motor, a factory mounted disconnect switch with motor overload protection suitable for the motor scheduled and factory isolated conduit from the motor compartment to inside the curb cap.

L. Each unit shall be furnished with an easily removable galvanized or polyvinyl coated steel hardware cloth birdscreen and a gravity backdraft damper. Damper shall be constructed of not less than .020 aluminum formed for rigidity and pivoted to an extruded aluminum or heavy rustproofed steel frame with nylon or brass bearings. Blades shall be connected together with pivoted aluminum tie rods.

M. Provide fan manufacturer's prefabricated minimum 24-inch high insulated metal roof curbs constructed of heavy galvanized steel or welded aluminum to match fan construction, full 2-inch thick heavy density internal insulation, rubber curb cap for fan base mounting, factory clips or attachment devices to secure fan tight to curb, counterflashing, wide roof flange, backdraft damper frame, and cant strip. Furnish complete and as recommended by the manufacturer.

N. Acceptable Manufacturers - Acme, Carnes, Greenheck, Cook, Jenn-Air, Penn, Twin City Fans.

2.9 INTEGRATED, PRE-ENGINEERED FIRE SUPPRESSION RANGE HOOD SYSTEM:

A. Fully integrated, pre-engineered fire suppression range hood system with capacities, fan, arrangement and accessories as scheduled.

B. Quality Control:

1. NSF Compliance: Equipment bears NSF Certification Mark (when required)
2. UL Listing: Equipment has been evaluated according to UL or ETL 300A and is labeled for intended use.
3. Fire-Protection Systems: to be pre-engineered and factory integrated into the design of the hood
4. Seismic Restraint:

   a. Comply with requirements in Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
   b. Comply with applicable guidelines for seismic restraint of kitchen equipment contained in SMACNA's "Kitchen Ventilation Systems and Food Service Equipment Guidelines," Appendix A.

C. The hood shall be constructed of 18 & 20 gauge (type 304) polished stainless steel. Hood shall have fire suppression system factory installed into the hood system. Activation of the mechanical fire suppression system shall be by 212 or 280-degree fusible link (30" vs. 36" sizes). Fire suppression agent will be Amerex 660 Low PH wet chemical suppressant. Unit shall include centrifugal fan with air delivery of 380 to 610 cfm depending of calibration of unit. Unit shall include fuel shutdown option for Gas, Electric or Dual Element Devices. The hood system will also have multiple alarm and monitoring contacts factory installed into the hood.

D. Hood system include commercial-grade grease extractor type, high efficiency cartridge style baffle filters of adequate number and sizes to ensure optimum performance in accordance with manufacturer's published information. The filter housing shall terminate in a pitched, full-length grease trough, which shall drain into a removable grease container.

E. Shatter proof light fixtures shall be included in the hood system. Wiring shall conform to the requirements of the National Electrical Code (NEC #70).

1. Pre-Installed Fire protection system to provide duct entry, plenum, and surface protection for hood system and equipment located below ventilator.
2. System interconnected with included shunt trip breaker and/or gas solenoid valve of equipment located below ventilator for power and fuel shutoff during system actuation.

F. Environmental Monitoring / Internal Monitoring / Pre-Suppression

1. Two temperature sensors are located on the inner face of the hood; one at a medium set point, the other at high. Under cooking conditions, when the medium set point is reached, the fan is turned on high. This feature dissipates the heat from the area but also draws it into the unit, past the fusible links in the system. If temperatures continue to rise and the high temperature set point is reached, the system reacts by shutting down power to the range prior to suppression system release. When this occurs, the unit's internal alarm is activated so that occupants are notified that the system is working to prevent further escalation of a potential fire. This is considered two stages of pre-suppression, where the unit is interacting with the cooking environment - working to minimize the risk of a fire event.

2. Should temperatures continue to rise, fire is present. The fusible links will melt, mechanically actuating the suppression system and releasing a low PH wet chemical agent across the cook-top. At actuation, the system will also make a second attempt to shut down power to the range; in the event of a flash-fire, or something that happens too quickly to register with the temperature sensors. The system will continue to sound its internal alarm while also communicating a "fire code" back to a monitored alarm panel.
3. The PLC Self-Monitoring-System also monitors the entire suppression assembly for completeness and continuity. If the suppression system is ever compromised through a loss of pressure or broken connection, or tampering of any kind, the unit reacts by shutting down power to the range. In this case the suppression system is compromised therefor the range shouldn't be in use. Under this condition, the system communicates a separate "maintenance code" saying that the unit is down and needs service. When preemptive shutdown occurs, the system and the cooking equipment will not come back on-line until the GRRS is reset.

G. Options (as scheduled):

1. Manual Pull Station (MPK) – Mechanical assembly allowing the fire suppression system to be actuated manually normally located at the point of egress.
2. The CLOCKBOX (CLBX)– Cooking Element Time-Out System allowing for separate control functionality over when the appliance is used.
3. NSF (NSF) – The hood system can be upgraded to the NSF Standard.
4. Handicapped Accessible Controls (ADA) – Separate control system designed to mirror the front-end controls of the hood, to be installed at under counter-top height.
5. Powder Coating (PC) – The hood system can be powder coated in a variety of standard colors, the manufacturer can also color match.
6. NFPA101 Upgrade (NFPA101) – Combines MPK, CLBX and an upgraded fan to deliver >500cfm in order to comply with the requirements of the NFPA Life Safety Code.

H. Acceptable Manufacturers – Greenheck, or approved equivalent.

2.10 TYPE I KITCHEN HOODS:

A. Kitchen ventilation hood shall be of the full canopy type. When scheduled, provide with rear supply air plenum to supply make-up air to the hood in a manner that does not interfere with the cooking operations beneath the hood(s).

B. The hood(s) shall be constructed of a minimum of 18 gauge stainless steel construction. Hoods shall be constructed using the standing seam method for optimum strength. The seams on the canopy shall be welded liquidtight, and all exposed external welds shall be ground and polished to match the original finish of the metal. Lighter material gauges, alternate material types and finishes (400 series stainless steel, cold rolled steel, etc.) and non-liquidtight welding (tack weld, spot weld, etc.) is not acceptable. Construction shall include corrosion-resistant steel framing members for strength. All unexposed interior surfaces shall be constructed of a minimum 18 gauge corrosion-resistant steel, including but not limited to ducts, plenum, framing and brackets.

C. Hood(s) shall include a filter housing constructed of the same material as the hood. Filters shall be (aluminum, U.L. Classified, and in sufficient numbers and sizes to ensure optimum

performance as specified by the filter manufacturer. The filter housing shall terminate in a pitched, full length, grease trough which shall drain into a removable grease drawer.

D. Vaporproof, U.L. Listed light fixtures shall be prewired to a junction box situated at the top of the hood for field connection. Wiring shall conform to the requirements of the 2000 National Electrical Code.

E. The hood(s) shall be constructed as U.L. Listed (with Fire Damper type canopies and built in accordance with National Fire Protection Association (NFPA) Bulletin #96, Building Officials and Code Administrators (BOCA), and bear the National Sanitation Foundation (NSF) Seal of Approval.

F. Fire Suppression System

1. Provide an Ansul or approved equal, R102 liquid fire suppression system for the range hood.
2. Provide with control panel, manual pull station, piping, nozzles, cables and other required equipment necessary for a complete operable system in accordance with NFPA-17A and NFPA-96. Coordinate with electric gas solenoid valve provided by plumbing contractor. Control panel shall have a minimum of two spare sets of form C, dry contacts to indicate activation of the hood fire protection system and to control fan start/stop relays.
3. Piping shall be run unexposed where possible. All exposed piping shall be encased in stainless steel or chrome plated steel pipe shall be used.

G. Controls

a. Provide the kitchen hood with a surface-mounted, control panel with stainless steel enclosure, for the purpose of switching and visual indication of operations. Each panel shall be mounted on the front of its respective exhaust hood (field verify location with Architect) and shall include the following items:

1) Engraved lamicoid labels for each switch/light.
2) Fan ON-OFF switch and light.
3) Hood light Switch (20A, 125VAC toggle type).
4) One (1) fan start/stop relays controlled by the fire protection signal contacts with power supply (only applies to hoods with fire suppression systems).
5) One (1) relay controlled by fire protection signal contacts to operate shunt trip circuit breakers (only applies to hoods with fire suppression systems).
6) One (1) relay for interface with building control system to signal when exhaust is running.
7) One (1) spare relay for incidental equipment and systems associated with hood safety operation.

H. Acceptable Manufacturers - Captive Air, Custom Aire, Duo-Aire, Econovent, Greenheck

2.11 BACKDRAFT DAMPERS:

A. See Section 238500.

2.12 EQUIPMENT MOTORS AND BEARINGS:

A. See Section 230100.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Install equipment in strict accordance with manufacturer's recommendations and requirements of other sections.

B. For units with outside air connections, an approved gasket or sealant material shall be provided between the wall and the back of the unit, around the outside air opening, to eliminate outside air infiltration into the room or into the unit through any path other than through the fresh air damper.

C. Coordinate responsibility for providing equipment roof curbs and flashings with roofing contractor. Coordinate curb type with roofing contractor to ensure curb's compatibility with roofing system and with curb-mounted equipment.

3.2 SPACE REQUIREMENTS

A. The Contractor shall field measure all existing clearances relative to receiving, transporting and installing equipment where indicated on the drawings. If necessary, the contractor shall disassemble unit and reassemble in final installed position. Such disassembly and reassembly shall be approved by and carefully coordinated with the equipment manufacturer.

3.3 INSTRUCTION FOR FAN COIL UNITS

A. Following the completion of work, the Owner's representative shall be given a minimum of two (2) two hour sessions of instructions on operation and maintenance of the completed systems. All training shall be by the respective equipment manufacturer's trained representative and shall utilize Operation and Maintenance manuals and as-built documentation.

1. Manual documentation shall include:

a. Operation sequences with specific to specific hardware components
b. Wiring diagrams.
c. Maintenance instructions.
d. Troubleshooting instructions.

B. Deliver to the Owner at the time of the first training session two complete Operation and Maintenance Manuals.

3.4 WARRANTY

A. Labor to troubleshoot, repair, reprogram, or replace system components shall be furnished by the mechanical contractor at no charge to the owner during the warranty period.

3.5 TESTING AND BALANCING

A. See Section 239900.

END OF SECTION 23 80 00

3.4 WARRANTY

A. Labor to troubleshoot, repair, reprogram, or replace system components shall be furnished by the mechanical contractor at no charge to the owner during the warranty period.

3.5 TESTING AND BALANCING

A. See Section 239900.

END OF SECTION 23 80 00

SECTION 23 85 00 - DUCTWORK AND ACCESSORIES

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Provide all necessary labor, equipment, and materials for a complete duct system, including all hardware and accessory devices.

B. Install instrumentation devices in the duct system, furnished under Section 23 90 00.

1.2 STANDARDS:

A. Ductwork shall be fabricated, erected and installed and fitted out with accessories in accordance with current editions of the following -
   1. Governing Building Codes.
   2. NFPA 90A.
   3. SMACNA HVAC Duct Construction Standards.

1.3 DEFINITIONS:

A. Pressure - Velocity Classification - classifications of duct construction as defined in SMACNA HVAC Duct Construction Standards, First Edition, 1985 (Table 1-1).

B. Insulated Ductwork - externally insulated as specified in Section 23 25 00.

C. Preinsulated Ductwork - ductwork constructed of insulating material or incorporating insulating material during fabrication.

1.4 SUBMITTALS:

A. Submit complete printed catalog and descriptive data for each major piece of equipment, clearly indicating exactly what features, options and accessories are being provided.

B. See Section 23 01 00.

1.5 OPTIONS:

A. Equivalent area round ducts may be substituted for rectangular ducts serving a single outlet provided the round duct tap is made into the rectangular with a round take-off fitting with integral volume damper as specified below.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Galvanized steel sheets, lock-forming quality, ASTM A-525 with galvanized coating for both sides of the sheet.

B. Paint grip galvanized steel sheets, lock-forming quality, ASTM A-527, with G/60 or G/90 coating for both sides of the sheet, minimum spangle, thin phosphate film shall readily accept paint.

C. Black steel sheets - conforming to ASTM A-366.

D. Aluminum base alloy sheets - conforming to ASTM B-209.

E. Proprietary Flanged Transverse Duct Joint Assembly - Ductmate system, applied and installed in accordance with manufacturer's published recommendations.

F. Duct Sealant - United, Foster, Hardcast, Minnesota Mining Manufacturing.

2.2 FLEXIBLE CONNECTIONS:

A. Woven nylon, 22 oz./sq. yd., 150 lb. tongue tear strength, 500 lb. tensile strength, flame retardant coating, proof fabric maximum 10-inches long, minimum 4-inches in direction of air flow.

B. Acceptable Manufacturers – Ductmate, Durodyne, Hardcast, Ventfabrics.

2.3 MOTORIZED DAMPERS:

A. Louver type with not less than 16 gauge welded steel frames and galvanized finish. Blades shall have interlocking edges, vinyl or neoprene gaskets, and Teflon coated stainless steel thrust washers. Blades shall be edged with neoprene.

B. Actuators shall be driven by electrically powered motors and shall be sized to operate their appropriate dampers or valves with sufficient reserve power to provide 2-position action. Provide adjustable positive stops or limit switches on each actuator.

C. Acceptable Manufacturers - Air Balance, Carnes, Empco, Greenheck, Krueger, Louvers & Dampers, Ruskin.

2.4 BACKDRAFT DAMPERS:

A. Provide heavy-duty shutter type dampers, with galvanized 16 gage or extruded aluminum frame and wind stops, minimum 28 gage galvanized steel or 26 gage aluminum blades, 3/16-inch steel shaft with "Oilite" bronze bearings, roll formed blade edged with felt sealer, blades linked with tie bar and adjustable counter weight, to allow full blade position parallel to air flow under full air flow with gravity closing of dampers on reverse flow.

B. Provide frames for required mounting and access doors required for complete adjustment of balance weight.

C. Fan manufacturer's backdraft dampers are acceptable where furnished and installed in conjunction with exhaust fan installations scheduled, and similar to above.

D. Acceptable Manufacturers - Air Balance, Carnes, Empco, Greenheck, Krueger, Louvers & Dampers, Ruskin.

2.5 VOLUME DAMPERS:

A. Provide manual balancing dampers with position locking mechanism as shown and as required to balance the air flow to each outlet or from each inlet.

B. Construction in accordance with SMACNA manuals.

2.6 FLEXIBLE DUCT:

A. Flexible duct shall be light weight duct formed with a resilient core of continuous, chlorinated polyethylene inner air barrier and insulated with resilient 1 1/2-inch thick fiberglass and jacketed with a tough scrim-reinforced aluminum vapor barrier and containing a totally encapsulated reinforcing wire helix.

B. Listed as UL 181, Class 1 duct. Complies with NFPA 90A.

C. Provide flexible duct clamps of self-locking nylon, or stainless steel with swivel action screw.

D. Acceptable Manufacturers - Flexmaster, Thermaflex.

2.7 BRANCH DUCT TAKE-OFF:

A. A round or rectangular take-off made from a rectangular supply, return or exhaust duct shall utilize a fitting having rectangular opening with 45° transition on main duct to round or rectangular collar on branch duct side of fitting. Fitting shall be equivalent to Wichita Sheet Metal Supply Co. model HETO.

B. A round take-off from a round supply, return or exhaust duct shall utilize a fitting having round opening with 45° transition on main duct to round collar on branch duct side of fitting.

C. Fitting shall include a butterfly damper with quadrant operator in branch duct collar, with stand-off platform to extend quadrant beyond duct wrap for insulated duct. Provide a wing nut at each end of damper shaft.

2.8 SHEET METAL HARDWARE:

A. Quality and configuration to conform to Ventfabrics, Inc. Piece number and description, as listed-

1. Ventfabrics No. 641 damper regulator, self-blocking, die- cast, secure to sheet metal on exposed and concealed ductwork above accessible ceilings.
2. Ventfabrics No. 677 damper regulator, self-blocking die- cast, chrome plated cover. To control ductwork located above an accessible ceiling or confined in wall spaces. Control from conditioned space.
3. Ventfabrics No. 607 damper end bearing, die-cast for rectangular ducts, with bearing and opening for shaft inclusion.
4. Ventfabrics No. 609 end bearing, die-cast for cylindrical ducts, with suitable gaskets, bearing and recess for shaft insertion.
5. Ventfabrics No. 615 and 616 tandem placed U-bolts, with washer and nuts to fix damper rod to damper blade.
6. Ventfabrics No. 699 die-cast instrument test hole, with screw, cap and gasket.
7. Ventfabrics No. 611, 160 F. fusible link, 15 lb. load capacity.
8. Ventfabrics No. 613, 212 F. fusible link, 15 lb. load capacity.
9. Ventfabrics No. 90, sash lock, cadmium plated stamp steel construction, for use on reach-thru doors.
10. Ventfabrics No. 220, die-cast door pulls for use on reach- thru access doors.
11. Ventfabrics No. 150, 2 x 1-11/16-inch galvanized duct hinges, minimum 2 hinges per door, for use on reach-thru access doors.

B. Acceptable Manufacturers - Duro-Dyne, Ventfabrics, Inc., Young Regulator.

2.9 FABRICATION:

A. Ductwork -
1. Fabricate in accordance with SMACNA HVAC Duct Construction Standards, latest edition.
2. Each duct system shall be constructed for the specific duct pressure of the system.
3. Pressure-Velocity Classification and seal class shall be as follows:

    a. Supply, return and general exhaust ductwork shall be galvanized sheet metal constructed per requirements for the 2" water gage pressure class and seal class "C". Exposed make-up air duct to range hoods shall be stainless steel.
    b. Kitchen hood exhaust duct shall be steel sheet with radius offsets, constructed per requirements for the 3" water gage pressure class. Concealed duct shall be fabricated from black steel, exposed duct shall be fabricated from stainless steel. All seams and joints shall be welded.
    c. Dishwasher exhaust duct shall be stainless steel or aluminum with radius offsets, constructed per requirements for the 2" water gage pressure class. Concealed duct shall be fabricated from aluminum, exposed duct shall be fabricated from stainless steel. All seams and joints shall be sealed watertight with silicone.
4. Seal supply, return, and general exhaust ductwork with Hardcast #601 water based, UL listed sealant or approved equivalent, in accordance with SMACNA HVAC Duct Construction Standards for required static pressure construction class and seal class.

B. Rectangular duct fittings-
1. Elbows, tees and splits shall be constructed with square turns or radius turns which shall have a centerline radius 1-1/2 times the width of the duct as an absolute minimum.

2. If square turns are used, fabricate and install hollow formed turning vanes in each turn for elbows turns for elbows having equal inlet and outlet dimensions.
3. Where elbows have unequal inlet and outlet dimensions, turning vanes shall have leading and trailing edges parallel with the air flow and shall be high efficiency profile type similar to those manufactured by the Aerodyne Company. Vane assemblies shall be made with Aerodyne side rails, and vanes shall be installed on design centers as for the vanes across the full diagonal dimension of the elbow. Cut center section of each rail as recommended by manufacturer so that the required position adjustment may be made.

C. Round duct - Spiral seam, butt welded longitudinal seam, or snap lock seam.
1. Up to 12-inch: 26 gage steel spiral seam, or 26 gage steel butt welded longitudinal seam or snap lock seam, with 26 gage steel duct fittings.
2. 13 thru 18-inch: 26 gage steel spiral seam, or 24 gage steel butt welded longitudinal seam or snap lock seam, with 24 gage steel duct fittings.
3. 19 thru 28-inch: 24 gage steel spiral seam, or 22 gage steel butt welded longitudinal seam or snap lock seam, with 22 gage steel duct fittings.
4. 29 thru 36-inch: 22 gage steel spiral seam, or 20 gage steel butt welded longitudinal seam or snap lock seam, with 20 gage steel duct fittings.
5. 37 thru 52-inch: 20 gage steel spiral seam, or 18 gage steel butt welded longitudinal seam or snap lock seam, with 18 gage steel duct fittings.
6. Joints-

a. Beaded sleeve joints on spiral duct, 1-inch minimum lap.
b. Beaded crimp joints, 1-inch minimum lap, 3 screws per joint.
c. Draw band joint, 4-inch minimum width, lap 2-inch over each section of duct, 2 draw bolts per joint, minimum.
d. Companion flange joint.

D. Round ductwork fittings-
1. Each 90 degree elbow shall be 2-piece welded, die formed construction, and shall have a center-line radius of not less than 1.5 times the duct diameter.
2. Each elbow between 45 and 90 degrees shall be 3-piece construction, with same center-line radius requirements.
3. Provide combination lateral elbow and tee, 90 degree tees, conical tees, double wye's and reducers each as required.

2.10 GRILLES, REGISTERS AND DIFFUSERS:

A. Provide as scheduled.

B. Increase size when required for installation in lined ductwork.

C. Air Distribution-
1. Supply units shall be designed to provide the throw and spread required with no apparent drafts or excessive air movements within the ventilated or air conditioned spaces.
2. Provide air distribution accessories required to effect these conditions as part of the supply unit.

D. Noise-

1. The noise spectrum of the supply units shall be no higher than N.C.-35 as defined in the latest issue of ASHRAE Guide.
2. Units causing excessive air movement, drafts or objectionable noise shall be replaced at no cost to the Owner.

E. Volume Control - Furnish supply outlets with key operated volume dampers, unless otherwise specified.

F. Gaskets - Flanges of diffusers, registers and grilles shall be gasketed with foam rubber gaskets to prevent leaking and smudging.

G. Finish - Furnish grilles, registers, and outlets in factory baked white enamel finish, also suitable as prime coat for finish painting in the field, except as otherwise specified or scheduled.

H. Acceptable Manufacturers - Air Concepts, Anemostat, Barber- Colman, Buensod-Stacy, Carnes, Carrier, Conners, Krueger, Metalaire, Titus, Tempmaster, Trane, Tuttle & Bailey.

PART 3 - EXECUTION

3.1 MATERIAL APPLICATION:

A. Galvanized steel sheets - use for fabrication of the following-
1. Supply, return, exhaust ducts except as otherwise specified.
2. Housings for coils, dampers, filters and fans.
3. Volume control dampers.
4. Intake and exhaust plenums, roof caps and goosenecks.
5. Hangers for ducts.
6. Flashing and counterflashing.

B. Paint grip steel sheets: use for fabrication of the following-
1. Exposed supply, return and general exhaust ductwork in locker rooms and other areas where noted on drawings.

C. Black steel sheets - use for fabrication of the following-
1. Concealed kitchen hood exhaust duct.

D. Aluminum base alloy sheets - use for fabrication of the following-
1. Concealed dishwasher exhaust ducts.

E. Stainless steel sheets - use for fabrication of the following -
1. Exposed dishwasher exhaust and range hood supply or exhaust ducts.

3.2 DUCT SIZE AND ROUTING:

A. Ductwork sizes and routing shown on drawings are schematic. Offset, flatten and maintain duct area, and reroute ducts where required to maintain headroom, clear light fixtures, pipes, conduits, structure and other construction.

3.3 INSTALLATION:

A. Flexible connectors-
   1. Install on inlet and outlet of each piece of air handling equipment.

B. Flexible duct-
   1. Secure to duct, apply heat resistant fire retardant compound to male end of each piece of duct, insert into flexible duct, secure with draw in accordance with manufacturer's instructions.
   2. Flexible ducts shall have developed length of not more than 4-feet and be supported to eliminate sagging and afford smooth 1-1/2 center-line (minimum) bends.
   3. Flexible duct shall not be installed above inaccessible ceilings or in other concealed locations.

C. Volume dampers-
   1. Install at each split in each run of duct.

D. Sheet metal hardware-
   1. Install as required and in accordance with manufacturer's recommendations.

E. Air devices-
   1. Each air outlet of each duct system shall be equipped with a balancing damper, either integral with the device or located in the individual branch duct to balance the airflow from that device.
   2. These devices shall be installed after the duct systems are thoroughly cleaned, with suitable accessories as specified or required for proper air distribution.

F. Automatic dampers -
   1. Install automatic dampers except dampers specified as integral parts of factory fabricated air handling unit components.

G. Dishwasher exhaust -
   1. Seal all seams and joints watertight with silicone and pitch at a minimum of 1/4-inch per foot to drain toward the hood connection or the "soiled" dishwasher connection, as applicable.
   2. All changes in direction shall be made with radius elbows.

H. Range hood exhaust -
   1. Weld all seams and joints watertight, pitch at a minimum of 1/4-inch per foot to drain toward the hood connections, and provide access doors in vertical faces, turning vanes are prohibited. Ducts shall either be enclosed in fire rated shaft construction by the General Contractor or wrapped with scheduled insulation, see plans and coordinate with General Contractor.
   2. All changes in direction shall be made with radius elbows.

3.4 ERECTION:

A. Hangers-
   1. Provide round hangers, strap hangers, or trapeze shelf hangers in accordance with SMACNA standards.

2. Rectangular ducts 0 thru 47-inches wide, use 18 gage galvanized strap, 10 feet on center, 1-inch strap.
3. Rectangular ducts 48-inches and wider, use trapeze hangers formed of angle iron under duct rigidly and securely supported to building structure by threaded rods, installed per SMACNA standards.
4. Cylindrical ducts - 0 thru 36-inches in diameter, use 18 gage galvanized strap, 10 feet on center, 1-inch strap.
5. Cylindrical ducts over 37-inches in diameter, use 16 gage galvanized strap, 10 feet on center, 2-inch strap.
6. For vertical ducts - 0 thru 24-inches in any dimension, use 1 x 1 x 1/8-inch galvanized angle. Secure angle to duct at each floor level, rest angle on building structure.

    a. Ducts 25-inches thru 60-inches use 1 1/2 x 1 1/2 x 3/16-inch galvanized angle.
    b. Ducts over 61-inches use 2 x 2 x 3/16-inch galvanized angle.
    c. Support to the building construction and secure to duct.
7. For cylindrical, double wall ducts, refer to drawings and SMACNA standards.
8. Support flexible ducts with 18 gage, 1-inch wide galvanized straps, with span lengths as short as necessary to prevent sagging.

3.5 ACCESS DOORS:

A. Provide duct access doors as required to clean kitchen hood exhaust ductwork. In other ducts, provide duct access doors as required to service each item of equipment mounted in the ductwork, including but not limited to-
1. Fire and combination fire/smoke dampers.
2. Automatic control dampers.
3. Coils.
4. Volume dampers.
5. Filters.
6. Controls devices.

B. Duct access doors shall be complete with latches, gaskets and frames, and shall be constructed in accordance with SMACNA manuals. Provide hinged doors wherever practicable, removable type otherwise. Access doors in insulated ducts shall be insulated.

C. Furnish access doors as specified in Section 23 01 00 for installation in the general construction wherever duct access doors would not otherwise be accessible.

D. Access doors shall be generously sized for the purpose intended. Demonstrate suitability of each to the satisfaction of the Architect.

3.6 TESTING:

A. Mechanical contractor shall test grease hood exhaust duct in accordance with the requirements of the 2006 International Mechanical Code. The duct shall be tested for leakage and liquid tightness, prior to concealment or insulating of any portion of the duct system.

B. See Section 23 99 00 for additional testing requirements.

3.7 COMPLETION:

A. Complete each entire duct system, perform testing and cleaning operations, and leave each system in a condition with the coils cleaned, the filters clean, and debris and foreign material removed from the duct system.

B. Install a suitable air diffuser, grille, or similar device to cover each duct outlet.

C. Paint bare metal interior surfaces of ducts which can be seen through air inlets or outlets with a flat black paint.

D. Operate system and prove them to be free from excessive noise, free from perceptible air leaks, free from vibration, and capable of delivering the air quantities scheduled.

END OF SECTION 23 85 00

SECTION 23 99 00 - TESTING, ADJUSTING AND BALANCING (HVAC)

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. This Section applies to the testing, adjusting, and balancing of all HVAC air and water systems in Divisions on 23 of the Specifications. Services shall include checking installations for conformity to design, measurement and establishment of fluid quantities of the mechanical systems as required to meet design specifications, and recording and reporting the results.

B. The mechanical contractor shall perform system cleaning, testing and start-up before commencement of the test and balance work.

1.2 QUALIFICATIONS:

A. Testing, adjusting and balancing (T-A-B) of systems shall be performed by a competent and experienced personnel, certified by the Associated Air Balance Council or National Environmental Balancing Bureau in those testing and balancing disciplines required for this project, having done similar work in the past, and whose qualifications shall be subject to approval.

1.3 SUBMITTALS:

A. Submit names and qualifications of all persons proposed for testing, adjusting and balancing of mechanical systems and equipment. T-A-B work shall not begin until approval of such submittal is obtained.

B. Submit report format as described below. T-A-B work shall not begin until approval of such submittal is obtained.

C. See Section 23 01 00.

1.4 REPORTS:

A. Provide reports and certificates required in each category of testing, adjusting and balancing, signed both by the technician performing the work and the Contractor as representing accurate, factual data, based on readings on the job. Include a listing of the instrumentation used for the procedures along with proof of instrument calibration. Prepare a schematic diagram for each item of equipment and system to accompany each respective report form.

B. Reports shall be submitted on 8-1/2 x 11-inch paper format. Submit format for recording data for approval prior to use. Include a copy of final reports in each Operating and Maintenance Manual.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS:

A. Provide all meters, instruments, equipment and materials necessary for performance of tests.

B. Testing apparatus, not part of the permanent installation, shall remain the property of the Contractor.

C. Provide gaskets, lubricants, and other expendable materials required to be replaced during the execution of this work.

D. Fixed-pitch pulleys required for fan adjustments shall be provided on an exchange basis by the party responsible for the equipment installation (applies to new equipment only).

PART 3 - EXECUTION

3.1 MECHANICAL CONTRACTOR RESPONSIBILITIES PRIOR TO COMMENCEMENT OF TEST AND BALANCE WORK:

A. Clean all dirt and debris from equipment.

B. Service all bearings, gear boxes, wearing surfaces and other equipment components requiring lubrication as recommended by the equipment manufacturer.

C. Check all motor driven equipment for proper rotation.

D. Tag all valves and label all equipment.

E. Clean all plenums and ductwork.

F. Perform start-up on all equipment to insure proper operation.

G. Replace air filters.

H. Check all refrigerant systems to insure that they are properly charged with refrigerant and oil, and that they are moisture free.

I. Check all control devices to insure that they are installed correctly and are operating properly.

J. Make preliminary settings and adjustments as required to insure all systems will operate satisfactorily while test and balance work is performed.

K. Provide a set of final shop drawings to the test and balance agency.

L. Furnish and install additional balancing valves, dampers, test plugs and gauge cocks if the test and balance agency determines that such additional items are required to properly balance the systems.

3.2 TEST AND BALANCE PERSONNEL RESPONSIBILITIES PRIOR TO COMMENCEMENT OF TEST AND BALANCE WORK:

A. Obtain design drawings, specifications, and submittals of mechanical equipment and temperature control diagrams, and become thoroughly acquainted with the design intent.

B. Walk the systems to become familiar with equipment locations and to determine variations of the installation from design.

C. Prepare schematic diagrams of ductwork and piping systems as installed to facilitate reporting.

D. Prior to beginning of testing, adjusting and balancing procedures, schedule and conduct a conference with the Engineer and representatives of the installers of the mechanical and temperature control systems. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting and balancing.

E. Schedule testing, adjusting and balancing procedures so that air conditioning systems are balanced during summer season and heating systems are balanced during winter season, including at least a period of operation at outside conditions within 5° F wet bulb of maximum summer design condition, and within 10° F dry bulb temperature of minimum winter design condition. Take final temperature readings during seasonal operation.

3.3 MECHANICAL CONTRACTOR RESPONSIBILITIES DURING TEST AND BALANCE WORK:

A. The mechanical contractor shall cooperate and assist the test and balance personnel in performing the test and balance work. He shall also provide craftsmen and/or technicians of the various trades as required to assist the test and balance agency in performing the test and balance work. The craftsmen and/or technicians provided shall be familiar with the installed systems.

3.4 TEST AND BALANCE PERSONNEL RESPONSIBILITIES DURING TEST AND BALANCE WORK:

A. Provide temperature controls contractor with temperature, pressure and flow measurements as required for the calibration and verification of temperature controls system operation.

B. Perform testing, adjusting and balancing procedures for the various systems as described herein and in accordance with applicable standards of the National Environmental Balancing Bureau, Associated Air Balance Council, and the American Society of Heating and Refrigeration Engineers 1991 Handbook, Chapter 34.

3.5 SYSTEM VERIFICATION AND CALIBRATION:

A. Provide attendance by a qualified technician to work in cooperation with other participants to calibrate, integrate, and verify operation of all components and equipment described in this work.

1. Make all repairs, adjustments and programming changes necessary to accomplish the desired operation of the HVAC systems.
2. See MECHANICAL SYSTEM VERIFICATION AND CALIBRATION of Specification Section 23 01 00 for complete requirements.

3.6 HEATING, VENTILATING AND AIR CONDITIONING SYSTEMS:

Note - items marked TBA shall be the responsibility of the Test and Balance Agency; items marked MC shall be the responsibility of the Mechanical Contractor.

1. TBA - Balance all new or existing supply and exhaust air systems that are part of this project in accordance with SMACNA and AABC standards, by the use of a direct reading instrument such as "Anemotherm" or "Velometer" which has been properly calibrated.
2. TBA -The quantity of airflow at each inlet or outlet shall be within 10 percent of the design cfm shown on the Drawings.
3. TBA - Blank-off sufficient filter area to simulate a dirty filter condition (maximum pressure drop across filter bank).
4. For variable volume systems, furnish typewritten data for both maximum cooling and maximum heating air delivery, tabulating –
   a. Quantity of air in cfm at each air supply outlet.
   b. Dry bulb temperature of the supply air.
   c. Outdoor dry and wet bulb temperature at the time the above tests are conducted.
5. TBA - Furnish typewritten data tabulating- a. Quantity of air in cfm at each air outlet and inlet.
   a. Dry bulb temperature in each room.
   b. Dry bulb temperature of the supply air.
   c. Outdoor dry and wet bulb temperature at the time the above tests are conducted.
6. MC - Adjust belts, sheaves and the alignment of air handling equipment.
7. MC - Where various combinations of sheaves must be installed on fan systems to achieve the correct air delivery, change the sheaves and continue to take successive readings until the correct combinations are installed.
8. MC - Oil or grease bearings in accordance with manufacturer's instructions.
9. TBA -Furnish typewritten data taken at each air handling unit, for both clean and dirty filter conditions, tabulating-
   a. Total quantity of supply air in cfm.
   b. Total quantity of return air in cfm.
   c. Total quantity of outside air in cfm.
   d. Rpm of each fan or blower.
   e. Rpm of each motor.
   f. Voltage and ampere input of each motor (one reading for each phase leg on 3 phase motors).
   g. Pressure in inches water gage at inlet and discharge of each fan or blower.
   h. Furnish manufacturer's fan curve with calculated operation condition shown thereon.
10. TBA - Furnish air handling unit test data for variable volume systems at both maximum system air delivery and maximum turn-down.

B. Outside/Return Air Mixing Chambers-

1. TBA, Test each outside/return air mixing chamber for air handling units to prove actual air mixture conditions as specified. Balance return and outside air quantities for mixing plenums to the flows specified.

a. TBA, Outdoor temperature at the time the above tests are conducted.

C. Fan Coil Units:
1. MC - Clean exterior surface of coil tubes and fins. Straighten fins.
2. TBA - Test outside/return air mixing chamber for a minimum of six representative fan coil units per floor to prove actual air mixture conditions as specified. The six units tested shall be selected to obtain representative data for units based on size and exposure. Adjust the open position of the outside air damper for each fan coil unit based on the positions determined for the tested units.
3. TBA - Furnish typewritten data tabulating-
   a. Entering and leaving water temperature (for cooling operation).
   b. Quantity of water flow in gpm.
   c. Fan speed setting.
   d. Dry bulb air temperature entering and leaving each coil (for cooling operation).

D. Rooftop Heating/Cooling Outside Air Supply Units -
1. MC, Adjust, align and service rooftop units in accordance with manufacturer's recommendations and as required to achieve proper operation. Oil or grease bearings in accordance with manufacturer's instructions. Adjust belts and sheaves. Where various combinations of sheaves must be installed on fan systems to achieve the correct air delivery, change the sheaves and continue to take successive readings until the correct combinations are installed.
2. Furnish typewritten data for each system, for both clean and dirty filter conditions, tabulating-
   a. MC, Suction and condensing temperatures, and pressures.
   b. TBA, Temperatures of entering and leaving condenser air.
   c. TBA, Ampere input of compressor motors under full load (for each phase leg).
   d. TBA, Rpm of each condenser fan and motor.
   e. TBA, Rpm of each condenser fan and motor.
   f. TBA, Quantity of supply air in cfm.
   g. TBA, Quantity of exhaust air in cfm.
   h. Entering and leaving supply air dry bulb and wet bulb temperature for supply air and exhaust air stream through energy recovery media.
   i. TBA, Evaporator face velocity in fpm.
   j. TBA, Evaporator entering and leaving dry and wet bulb temperature.
   k. TBA, Total quantity of supply air in cfm.
   l. TBA, Total quantity of return air in cfm.
   m. TBA, Total quantity of outside air in cfm.
   n. TBA, Rpm of each supply fan or blower.
   o. TBA, Rpm of each supply fan motor.
   p. TBA, Voltage and ampere input of each fan motor (one reading for each phase leg on 3 phase motors).
   q. TBA, Pressure in inches water gage at inlet and discharge of each supply and exhaust fan or blower.
   r. TBA, Heat exchanger entering and leaving dry bulb temperature.
   s. TBA, Outdoor temperature at the time the above tests are conducted.

E. HVAC Water Piping Systems:
1. MC - Test hydrostatically to pressure of 75 psi in excess of the operating pressure.
2. MC - Flush and clean piping until the water runs clean.

3. MC - Repair leaks and retest.
4. MC - Test shall be repeated until the entire system is tight.
5. MC - Final pressure test shall be maintained for at least 24 hours.

F. Exhaust Fans -
1. MC, Adjust, align and service exhaust fans in accordance with manufacturer's recommendations and as required to achieve proper operation. Oil or grease bearings in accordance with manufacturer's instructions. Adjust belts and sheaves. Where various combinations of sheaves must be installed on fan systems to achieve the correct air delivery, change the sheaves and continue to take successive readings until the correct combinations are installed.
2. TBA, Furnish typewritten data for each exhaust fan, tabulating-
   a. Total quantity of exhaust air in cfm.
   b. Rpm of fan.
   c. Rpm of motor.
   d. Voltage and ampere input of fan motor (one reading for each phase leg on 3 phase motors).
   e. Pressure in inches water gage at inlet and discharge of fan.

G. Kitchen Hood Systems –
1. TBA, Perform testing of kitchen equipment ventilation systems in accordance with the requirements of the 2012 International Mechanical Code, to verify exhaust airflow, capture and containment.

H. Electric Heaters:
1. TBA, Furnish typewritten data for each system, tabulating -
   a. Voltage and ampere input of heating coil and fan motor, as applicable (one reading for each phase leg on 3 phase loads).
   b. Entering and leaving air temperature with heating coil energized.
   c. Outdoor temperature at the time above test is conducted.

END OF SECTION 23 99 00

SECTION 25 90 00 - TEMPERATURE CONTROLS

PART 1 - GENERAL

1.1 SCOPE:

A. Provide a complete and operating fully functional Building Control System (BCS) of electronic digitally processed temperature control system with energy management and monitoring functions for the building HVAC equipment and other systems included as part of the work for this Division.

B. The controls specified in this section will be an expansion of the existing Johnson Controls Inc. system already serving the existing building.

C. The BCS shall be comprised of a series of BACnet compliant digital controllers and sensors and network extension to connect to the existing control and energy management system. Provide additional programming, adjustment, and/or configuration of the system administrative software to provide user monitoring and operation of the HVAC equipment consistent with the existing user interface.

D. Electric controls and mechanical devices for all HVAC items indicated on drawings, required for implementation of the operating sequences and as described hereafter including electronics, dampers, valves, wiring, interface devices and panels.

E. A communications network to allow data exchange from each electronic controller to each other, controllers to user interface units and to a main user interface personal computer. Provide all interface components, routers, bridges, switches, hubs, modems and like communications equipment necessary for full access of the BCS network to the building operator.

F. Installation, check out and calibration of all control devices and systems including HVAC equipment manufacturer supplied control devices supplied by this Division and all other HVAC controls supplied under this contract.

G. Provide all software tools for installation, operation, modification and adjustment of control programs and electronic controller resident firmware settings. Provide licenses for all software residing in the BCS and user interface and transfer these licenses to the Owner prior to completion.

H. The requirements of Section 23 01 00, Basic Mechanical Requirements, apply to this work.

1.2 RESPONSIBILITY:

A. This Contractor shall be responsible for the complete installation of the control systems for all electrical equipment, including all power supply and control signal wiring and ancillary equipment necessary to provide a complete and fully operative control system as herein specified. Where required by applicable codes, this contractor shall provide the services of a licensed electrician to complete this work.

B. Any electrical installation not specifically indicated on the electrical plans shall be the responsibility of this contractor.

C. All indications or notations of specific field points and equipment components are intended to represent a subset of the complete hardware and requirements for this work. Provide all hardware, software, wiring and pneumatic installation required for a complete system with fully functional operation as described herein.

D. Provide all required control equipment, circuitry, interface and connections for smoke control implemented by HVAC equipment and components. Refer to drawings and control sequences for other related information.

1.3 ACCEPTABLE MANUFACTURERS:

A. Johnson Controls, Inc.

1.4 QUALITY ASSURANCE:

A. Installer:

1. This system shall be engineered, installed, started and calibrated by a factory authorized and currently certified supplier.
2. Installer shall have a minimum of five years experience in the installation of temperature control systems of similar size and scope.

B. Design Criteria: Proposed substitutions shall be submitted in accordance with procedures outlined elsewhere in this Specification.

C. The system shall be installed by competent mechanics, regularly employed by the controls manufacturer with full responsibility for proper operation of the system including debugging and calibration of each component in the system.

1.5 SUBMITTALS:

A. Shop Drawings: Submit in accordance with other sections of this Specification. Indicate construction materials, sizes, capacities, quantities, and related hardware requirements.

B. Instructions: Furnish Owner with Instruction Manual describing operation of temperature control system in accordance with other sections.

C. Submit the following for each control system:

1. System architecture showing all digital devices and interconnection.

    a. A complete field points list shall be included.

2. Data sheets of all products

3. Valve, damper and well and tap schedules showing size, configuration, capacity, pressure drop and location of all equipment.
4. Data forms for identification of initial and user adjustable parameters.
5. Equipment lists of all proposed devices and equipment.
6. Software design data including:

    a. Sequence of operation relating to all flowchart functions.
    b. List of all programmed alarm points with proposed initial alarm threshold setpoints.

7. Written commissioning and checkout procedure for each control system.
8. Submit maintenance brochures after completion of the work. The maintenance brochure shall include operating instructions, specifications, and instruction sheets for each instrument, and a complete set of record drawings.

D. Submittal shall also include a control network schematic diagram depicting connected devices and a description of the communication type and media.

1. The network infrastructure shall conform to the published guidelines for wire type, length, number of nodes per channel, termination, and other relevant wiring and infrastructure criteria as published. The number of nodes per channel shall be no more than 80% of the defined segment (logical or physical) limit in order to provide future system expansion with minimal infrastructure modifications.

E. Upon completion of the work, provide a complete set of ‘as-built’ drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ compatible files. Eight copies of the ‘as-built’ drawings shall be provided in addition to the documents on compact disk. Mechanical and Electrical contractors shall provide as-builts for their portions of work. This contractor shall be responsible for as-builts pertaining to overall BCS and FMS architecture and network diagrams. All as-built drawings shall also be installed into the FMS server in a dedicated directory.

F. See Section 23 01 00 for additional submittal requirements.

1.6 COORDINATION:

A. Manufacturer shall be responsible for details and dimensions not controlled by job conditions and shall show on his shop drawings required field measurements beyond his control. Coordinate with responsible trades to establish, verify, and maintain field dimensions and job conditions.

B. Consult with other trades in advance and make provisions for their work to avoid cutting and patching.

C. Where control system components interface to mechanical equipment or internal controls this Contractor shall be responsible for signal conversion, adjustment or configuration so as to conform to the equipment manufacturers' strictest requirements. Provide all hardware, software, wiring and installation required.

PART 2 - PRODUCTS

2.1 LOCAL CONTROL PANELS:

A. Provide standard cabinets. Controllers, relays, switches, terminal strips, interface devices, time clocks and similar devices except limit and safety controllers shall be located inside fully enclosed painted steel cabinets equipped with grounding backboards. Equipment room panels shall have hinged doors and shall also contain all power supplies, load relays, transducers, and associated equipment.

B. All panel electronics, discrete control components and interface devices shall be installed in suitable enclosures. Groups of devices serving a single air unit or equipment system within a single room shall be installed in the same enclosure.

2.2 CONTROL VALVES:

A. Shall be pressure and temperature rated equal to or greater than general service valves specified for the system. Valves shall be straight-through or three-way type as specified in the sequence of operation or as scheduled.

B. Sizing-
1. Modulating 3-way water valves shall be sized (unless indicated otherwise) to produce a full flow valve pressure drop approximately 1.5 times the full flow pressure drop of the unit (coil or heat exchanger) served.

C. Automatic control valves through 2-inches in size shall be brass body, threaded connections. Control valves 2- 1/2-inches and larger shall be iron body with flanged connections. Unless otherwise indicated, valves shall have removable packing and be straight-thru pattern designed for tight shutoff.

D. Water control valve stems shall be polished stainless-steel and packing shall be suitable for both chilled water and 250 degree hot water service.

E. Provide equal percentage valves for proportioning water coil (air conditioning) control valve application.

F. Provide 3-way valves arranged for diverting or mixing operation as shown, single or double seated, and two-position or equal percentage modulating, as appropriate for the duty.

G. All control valves shall be selected and actuators sized for silent operation.

2.3 MOTORIZED DAMPERS:

A. Louver type with not less than 16 gauge welded steel frames and galvanized finish. Blades shall have interlocking edges, vinyl or neoprene gaskets, and Teflon coated stainless steel thrust washers. Blades shall be edged with neoprene.

B. Dampers shall be not more than 48-inches in length between bearings. Modulating dampers shall be of the opposed blade type unless specified otherwise. Blades shall not be over 8- inches in width and shall not be less than 16 gage galvanized steel. Hardware shall be zinc plated. One damper actuator shall be provided for each 16 square feet of damper area.

C. Provide dampers of low leakage construction, so designed that the maximum leakage shall be 10 CFM per square foot of damper with 4-inches WC pressure differential applied.

2.4 ACTUATORS:

A. Actuators shall be driven by electrically powered motors and shall be sized to operate their appropriate dampers or valves with sufficient reserve power to provide smooth modulating action or 2-position action as specified. Provide adjustable positive stops or limit switches on each actuator.

B. Coordinate spring range requirements of actuators and provide appropriate scale and software factoring for each actuator to be properly positioned in response to its respective controller output signal.

C. Provide damper actuators for automatic control dampers furnished for outside air intake louvers or roof caps and combustion air openings.

2.5 ROOM THERMOSTATS:

A. Electric primary control device -
1. Wall mounted room thermostats shall have setpoint adjustment means, locking covers and no thermometers.
2. On/off type: Bimetallic, snap acting mechanism with 120 volt pilot duty capability, heating and cooling anticipation and separate heating and cooling contacts for automatic changeover. Range of 55 to 95 deg F. and differential of 0.6 deg F heating and 1.0 deg F. cooling.
3. Proportional type: Vapor charged sensing element operating with either one or two replaceable, 135 ohm potentiometers and adjustable throttling range and setpoint.
4. Scale range of 30 F. Normal set point shall be in the approximate center of the scale range.
5. Electric thermostats shall be line voltage or low voltage type, suitable for the application. Low voltage type heating thermostats shall have adjustable heat anticipation.

B. Electronic digital controller input device -
1. Wall mounted room thermostats shall have electronic temperature sensor and setpoint adjustment means.
2. Setpoint adjustment range of 55 to 95 deg F.
3. Electronic thermostats shall obtain power from the connected controller.
4. Setpoint adjustment shall function by software interaction with manually adjustable variable input signal, not by hardware biasing of temperature sensor at thermostat. Range of setpoint adjustment shall be controlled by user accessible head end software limitations.

5. Each thermostat shall have an integral override button. The button will signal the respective controller to run the unit and signal the other controllers for system wide functions required for operation of the unit. The override operation shall be for predetermined programed time span.

2.6 2.08 FREEZESTATS:

A. Manual reset, continuous 20-foot element vapor tension type, adjustable set point, 15 F. to 55 F., mechanical stop to limit control point adjustment below predetermined minimum. The sensing element shall be responsive only to the lowest temperature along its entire length.

2.7 ELECTRIC SYSTEM DEVICES:

A. All electric switch devices shall be selected for the applied load and UL listed for the application. All water thermostats shall be provided with a separate copper, monel or stainless steel well.

B. All automatically controlled devices, unless specified otherwise, elsewhere, shall be provided with electric actuators sized to operate their appropriate loads with sufficient reserve power to provide smooth modulating action or two position action and tight close-off. Actuators shall provide the minimum torque required for proper valve close-off against the system pressure for the required application. All direct shaft mount rotational actuators shall have external adjustable stops to limit the travel in either direction.

1. Where two or more actuators are to be operated in sequence with each other, sequencing shall be by signal sequencing with separate analog outputs.

C. Provide transducers, 2-position relays, sequencing relays, and other controls necessary to comply with the scheduled control sequences and provide for properly operating the automatic control system.

1. Relays shall have C isolated contacts rated for 1.5 load amperes and horsepower if switching power supply to a motor.

D. Provide low voltage power supplies and/or transformers where required for supplied component operation. Power supply devices shall be installed in enclosures with fusing and disconnecting means. All power supply equipment associated with an electronic controller shall be monitored by the digital control system. An input shall be utilized to sense operation of the power supply. If the supply fails a system alarm shall be generated.

2.8 DATA INPUTS AND OUTPUTS:

A. Input/output sensors and devices shall be closely matched to the requirements of the remote panel for accurate, responsive, noise-free signal input/output. Control input response shall be high sensitivity and matched to the loop gain requirements for precise and responsive control. In no case shall computer inputs be derived from pneumatic sensors or thermocouples.

B. Temperature sensors shall be precision thermistors or resistance temperature detector type with high thermal resistive coefficients for the range to be measured.

1. Space temperature sensors shall have external setpoint adjustable knob scaled with blue for cooler and red for warmer and override buttons. Provide blank locking covers for space temperature sensors located in gymnasiums, locker rooms, or public corridors.

2. Space humidity sensors shall be integrated into the space temperature sensor enclosures.

3. Duct temperature sensors shall be rigid stem (12 inches minimum) or averaging type (20 feet minimum) as specified in the sequence of operation. Water sensors shall be provided with separable copper, monel or stain less-steel well.

C. Relative humidity sensors shall be capacitance type with 10% to 90% range. Duct mounted humidity sensors shall be provided with a sampling chamber. Wall mounted sensors shall be provided with blank covers.

1. Room humidity and temperature sensors shall be mounted in wall or ceiling mounting brackets with removable brushed stainless covers specifically design for finished space applications. Sensor enclosures shall be of minimum size required.
2. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R enclosure with sealtite fittings and stainless steel bushings.

D. Carbon dioxide sensors shall be low voltage powered analog sensing devices utilizing non-dispersive infrared technology for measuring carbon dioxide parts-per-million concentration levels. The sensor shall have: diffusion gas sampling, 0-1900 ppm range, ± 5% of reading accuracy, ± 20 ppm repeatability, ± 100 ppm annual drift, < 20 second response time, 0-2 VDC linear output, 1000 ohm output impedance with zero and span adjustments. Equivalent to Telaire Systems model 1050. Provide duct air sensors with gas tight aspiration box to limit sensed air supply from duct. Provide wall mount sensors with blank covers.

E. Current sensing switches shall be adjustable from 0.2 to 20 amperes or a higher range where applicable with 5% repeatability. Set current switches to release at a level between a normally loaded condition and unloaded condition so that a lost coupling or belt occurrence is detectable. For variable speed or two-speed motorized equipment calibrate and test to detect operation of equipment at lowest speed.

F. Control relays and analog output transducers shall be compatible with electronic controller output signals. Relays shall be suitable for the loads encountered.

2.9 BCS CENTRAL HARDWARE:

A. For the system interface provide all required hardware, software, programming and interface equipment needed to permit full system communication and operation with the existing building control system.

B. Provide system PC with all hardware, software and programming necessary for system operator interface and system control at the site.

2.10 REMOTE HVAC CONTROLLER HARDWARE

A. Plant Controller Units (PCU)
   1. Plant Controller Unit shall be dedicated microprocessor based controllers with EPROM operating system. DDC programs and data files shall be non-volatile EEPROM or flash memory to allow simple additions and changes. Each PCU shall have an on-board realtime clock with battery backup of a minimum of 30 days.
   2. Remote PCUs shall be provided where shown on plans, specified or required for implementation of the control sequences with capacity to accommodate input/output (I/O) points required for the application plus spare points specified. These panels shall be configured with analog and digital inputs and outputs, and pulse counting totalizers such that the primary input, output, and all control logic shall be resident in a single microprocessor to provide network independent stand-alone closed loop DDC. Each panel shall be provided with a socket for a Portable Operators Terminal (POT). All panel inputs shall be selected for the application utilizing appropriate sensor types. PCU outputs shall be binary for On-Off control, and true variable voltage (0-10v) or variable current for driving analog electronic devices. Analog outputs shall have a minimum incremental resolution of one percent of the operating range of the controlled device.
   3. PCUs shall be designed for complex DDC and energy management applications, peer-to-peer communications with other PCUs. Each PCU shall have an integral real-time clock for true stand-alone operation (software clocks are not acceptable).
   4. All PCUs shall be installed in a unitized steel, aluminum or plastic conforming to UL94-5V cabinet with a latching door. All devices shown on the control drawings as panel mounted devices shall be contained inside the control cabinet housing the DDC controller.
   5. Plant controllers must operate without communications to Web interface.

B. Terminal Equipment Controllers (TEC)
   1. Terminal Equipment Controllers shall be standalone EEPROM based, and with I/O selected for the application plus specified spares. TECs shall be capable of processing sensor signals of the applications specified, and shall have capability to drive outputs required by the application. TEC enclosures shall be compact plastic conforming to UL94-5V or plated steel.
   2. Each TEC shall be provided with LED type annunciation to continually display its operational mode; power, normal, or in an alarm state.
   3. Networks of TECs shall be managed by a peer bus connected PCU or equivalent programmable device.
   4. TEC networks shall be grouped with up to 100 TECs per peer bus connected device.
   5. TECs shall be provided with a communications network port, and shall be UL916 listed.

2.11 CONTROL SOFTWARE:

A. Control Software:
   1. Each PCU shall contain up to five unique user modifiable time programs. Each time program shall consist of daily, weekly, and annual programs plus one day override temporary function.
   2. Control Application Software shall be customized strictly to meet the requirements of the "Sequence of Operation" specified hereinafter or on the project drawings. All control strategies shall be implemented with stabilizing setpoint ramps and procedures to assure

slow loading of variable load equipment and economizer modes to prevent unsafe operation of equipment, overshoot of controlled pressure or temperatures during start-up and transition periods.

3. Control programming must be standalone and capable of full operation in occupied mode with communications to the system gateway disconnected.

B. Management Software:

1. Trending. In addition to supporting trending specified elsewhere, each PCU shall be provided with a trend archive of at least the last 200 events (digital transitions or analog value changes) of any user selected group of up to 20 points. A stored event shall include date and time, and value or status. Events occurring in excess of 200 shall overwrite the oldest events.
2. Alarms. Each PCU shall monitor and report all analog input points and specified digital points for off-normal conditions. Each alarm shall have an "alarm delay" attribute which shall determine how long (in seconds) a point must be off-normal prior to being considered in an alarm state.
3. TEC Support. PCUs and devices managing sub-networks of TECs shall report TEC alarms and shall be programmed to perform data reduction, sorting, and AHU PCU optimizing routines. In no case shall mass TEC optimizing data be allowed on the primary bus.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install complete a control system including: Wiring, thermostats, controllers, sensors, transducers, control operators, transformers, relays, switches and other necessary devices.

B. Provide complete systems to accomplish the indicated sequence of operation.

C. Provide wiring and components for limiting, timing and interlocking required for safe operation of controlled equipment in accordance with manufacturers' recommendations.

D. Install all control components in strict accordance with manufacturer's recommendations.

E. All room thermostats, temperature and humidity sensors shall be installed 4'- 0" A.F.F. unless otherwise noted.

F. The Building Control System (BCS) shall be designed, installed, and commissioned in a turnkey, fully implemented and operational manner including all labor and materials required for the completion of these systems and not noted in other sections of these specifications.

G. All wiring shall be properly supported and run in a neat and workmanlike manner. All wiring in finished areas with exposed structure shall be installed in conduit. ALL WIRING AND RACEWAYS SHALL BE ATTACHED TO THE BUILDING STRUCTURE AND ROUTED ABOVE THE BOTTOM OF THE STRUCTURAL COMPONENTS. All wiring and tubing exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All piping and wiring within enclosures shall be neatly bundled and anchored to prevent

obstruction to devices and terminals. All control circuitry shall have independent support from other building systems.

H. The BCS contractor shall be responsible for all electrical installation required for a fully functional control system and not required by the electrical plans and specifications as Division 26 work. All wiring shall be in accordance to all local and national codes. All line voltage wiring, all wiring exposed in finished areas shall be installed in conduit and in accordance to the electrical specifications. All electronic wiring shall be #18 AWG minimum, plenum rated cable and shielded if recommended by the manufacturer for the application. All wiring in the mechanical rooms shall be installed in an approved manner.

I. The BCS contractor shall enter all computer programs and data files into the related computers including all control programs, initial approved parameters and settings, and English descriptions.

1. The BCS contractor shall maintain CD ROM copies of all data file and application software for reload use in the event of a system crash or memory failure. One copy shall be delivered to the owner during training session, and one copy shall be archived in the BCS contractor's local software vault.

J. Provide modifications to software throughout the warranty period to accommodate the mechanical systems behaviors observed in real life operation and the Owner's determination of optimal scheduling and system sequences.

3.2 SEQUENCE OF OPERATION: See drawings for equipment specific control sequences.

A. Sensor monitoring:

1. Alarm the failure of any system sensor by comparison against normal high and low limits of sensed variable. Provide user adjustable threshold setpoints for all alarm levels.

B. Alarms

1. Alarms, general:

a. Loss of signal - all system inputs.
b. Failure of all sensors.
c. Failure of all system controller communications.
d. Failure to start all motorized and heating equipment.
e. Failure to start all fans and pumps.
f. Loss of status with run command.
g. All system temperatures - outside of operating limits.
h. All system pressures – outside of limits.
i. Rapid cycling of any equipment.

2. Other equipment alarms:

a. Alarm from manufacturer control panel (i.e. sewage ejector panel).
b. LonWorks or Bacnet interface transmitted failure or alarm.
c. Smoke detector activation where applied for fan control.

3. Intelligent alarm function:

    a. Where cycling of threshold variable is expected during normal sequencing (i.e. low pressure during fan wind-up) alarm function shall incorporate adequate time delay or other applicable discrimination logic to avoid nuisance alarms.

C. Monitoring system operation:

1. Provide trend logs of the system data and store data on the Facility Management System server.
2. Record every 15 minutes:

    a. All temperature sensor points including duct, piping and room sensors.
    b. All room temperature sensor setpoints.
    c. All humidity sensor data
    d. All carbon dioxide sensor data

3. Record change of state:

    a. All smoke detector alarms.
    b. All fan status.
    c. All compressor run status.

3.3 FAIL-SAFE OPERATION:

A. Control operators shall be selected, applied and installed in such a manner that upon a local power failure, the "normal" position of each operator shall be such that no physical damage will be caused to any equipment as a result of loss of control power or electrical power to control devices or the entire unit.

B. Power Fail / Auto Restart: Provide for the automatic orderly and predefined shutdown of parts or all of the BCS following total loss of power and loss of power to portions or of the BCS. Provide for the orderly and predefined scheduling of controlled equipment to return to normal, automatically time scheduled, operation as a result of the auto restart processes.

C. Maintain the BCS real-time clock operation during periods of power outage for a minimum of 72 hours.

3.4 Alarms:

A. Sensor monitoring: Alarm the failure of any system sensor by comparison against normal high and low limits of sensed variable.

1. Each room temperature sensor shall have an associated alarm with separate alarm levels for occupied periods and unoccupied periods.
2. Each room humidity sensor shall have an associated alarm with separate alarm levels for occupied periods and unoccupied periods.
3. Each carbon dioxide sensor shall have an associated alarm with separate alarm levels for occupied and unoccupied periods.

B. Provide alarm reporting and functionality consistent with the existing system functions.

C. Alarms shall be functionally intelligent so that high or low sensed levels will not be alarmed when the associated equipment or system is not active. i.e. water temperature shall not be alarmed when the associated pumps are off and shall be delayed to allow the starting system to 'catch up' and gain control of the sensed variable.

3.5 SOFTWARE CUSTOMIZATION:

1. Provide customization of front end software to facilitate user operation and maintenance of controlled equipment.
2. Provide simple one-step means of implementing manual start/stop of each HVAC equipment item. Each equipment item shall be equipped with a manual override feature with a user defined time period.
3. Manual control of selected equipment items or systems shall automatically initiate start up of other required systems to permit selected equipment operation. (i.e. If an fan coil is selected for off hours operation the chilled water pump will start automatically.)
4. Provide display real-time reports for each mechanical equipment item and HVAC system. Each report shall display all sensed data points, system output statuses, setpoints, system variables and other relevant data.
    a. Provide display reports of sensor data provided by equipment BacNet interface of all equipment under operation of equipment manufacturer supplied controllers equipped with BacNet.
5. Provide displays that indicate relevant temperatures and identify setpoints for all like equipment. Provide a display for each group of equipment units.
6. Provide displays that indicate all room temperatures and related setpoints.
7. Provide displays that facilitate user adjustment of all setpoints for each equipment item, each HVAC system or each similar equipment group.

3.6 VALIDATION:

A. The BCS contractor shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the specifications and sequence of operations submitted.

3.7 ADJUSTING:

A. Adjust and place entire system in operation. Provide readjustment necessary to accomplish specified results during the guarantee period.

B. All setpoints, reset schedules, time delays, gain factors, span constants, etc. shall be adjusted by testing operation of the air and water handling systems and logging results.

C. Coordinate calibrating efforts with the project test and balance agency for verification of temperatures, pressures and flows. Include system adjustment operation logs in the O & M Manuals.
    1. Coordinate sequencing of compressorized equipment with equipment manufacturer recommended operation and time delays.

2. Provide all safeties and operating limits recommended by equipment manufacturers.

D. Corrective software modifications shall be made during the check-out and start-up periods. Software parameters and entire algorithms shall be updated or replaced to optimize the operation of building equipment and system effectiveness. All software tuning and adjustment shall be made in close coordination with the equipment supplying contractors and the equipment manufacturers to ensure proper operation. Record all changes and update all user documentation and on user and manufacturer archived software disks.

E. Provide adjustments and changes to control software requested by Owner after one year (all seasons) of operation. This programming service shall be provided under the system construction warranty. The contractor shall notify the Owner and request changes and implement prior to completing the warranty period.

3.8 TRAINING:

A. All training shall be by the BCS contractor and shall utilize specified manuals and as-built documentation. See list of required documentation below.

B. Following the completion of work, the Owner's representative shall be given a minimum of (2) two hour sessions of instructions on operation and maintenance of the completed system. Training topics shall include:

1. Sequence of Operation review
2. Selection of all displays and reports
3. Troubleshooting software

C. After the one year warranty period provide a scheduled training review session for one half day. Coordinate this session with the Owner's schedule so that he may arrange attendance by appropriate staff.

3.9 SYSTEM VERIFICATION AND CALIBRATION:

A. See Section 23 01 00.

3.10 WARRANTY:

A. All components, system software, parts and assemblies supplied by the BCS contractor shall be guaranteed against defects in materials and workmanship for one year from acceptance date.

B. Labor to troubleshoot, repair, reprogram, or replace system components shall be furnished by the BCS contractor at no charge to the owner during the warranty period.

C. All corrective software modifications made during warranty service periods shall be updated on all user documentation and on user and manufacturer archived software disks.

3.11 DOCUMENTATION:

A. An Operators Manual shall be provided with graphic explanation of keyboard use for all operator functions specified under Operator Training.

B. A manual shall be provided including revised as-built documents of all materials required under the paragraph "SUBMITTALS" on this specification.

C. Two Operators Manuals and four As-Built Manuals shall be provided to the owner.

END OF SECTION 25 90 00

SECTION 26 01 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL:

A. All work covered by this section of these specification shall be accomplished in accordance with the respective drawings, information or instructions to bidders, general requirements, and the general conditions of these specifications. Any supplementary conditions, special conditions, addenda, or directives which may be issued by the Architect herewith or otherwise shall be complied with in every respect.

B. Bidders shall determine the contents of a complete set of drawings and specifications and be aware that they may be bidding from a partial set of drawings, applicable only to the various separate contracts, sub-contracts, or trades as may be issued for bidding purposes only. The complete scope of work for the electrical trade in this project are illustrated on the complete Contract Documents which consist of the combined Architectural, Structural, Plumbing, Heating, Ventilating, and Air Conditioning plans and specifications. Each Bidder shall thoroughly acquaint himself with all the details of the complete set of drawings and specifications before submitting his bid. All drawings and specifications form a part of the contract documents for each separate contract and shall be considered as bound therewith in the event partial sets of plans and specifications are issued for bidding only. The submission of bids shall be deemed evidence of the review and examination of all drawings, specifications, and addenda issued for this project as no allowances will be made because of unfamiliarity with any portion of the complete set of documents.

C. Connect new work to existing work in neat and approved manner. Restore existing work disturbed to original condition.

D. Existing systems shall be left in perfect working order upon completion of all new work.

E. Any equipment which is removed and not reinstalled shall be delivered on site to the Owner, or removed by the Contractor, as directed by the Owner.

1.2 SUB-CONTRACTOR QUALIFICATIONS:

A. Sub-Contractor (as a company) and his job superintendent for their portion of the work shall have at least three years of satisfactory experience in completion of projects of comparable size and complexity. Evidence of this experience will be required before approval of the Architect as being acceptable for their portion of the work.

1.3 SCHEDULE:

A. The schedule and sequence of work must be carefully coordinated through the General Contractor, with the Owner, to ensure that all work performed within the existing building will result in a minimal amount of noise, dust and disruption to the activities in the existing building.

B. All interruptions of existing services must be coordinated through the General Contractor, with the Owner, to minimize inconvenience and disruption to the activities in the existing building. All interrupted services shall be restored as quickly as possible. All interrupted systems shall be thoroughly cleaned and tested prior to being placed back into operation.

1.4 SCOPE:

A. The work included under this specification consists of the furnishing of all labor, materials, tools, transportation, services, etc., which are applicable and necessary to complete the installation of the systems described in these specifications, illustrated on the accompanying drawings, or as directed by the Architect.

B. In general, the various lines and raceways to be installed by the various trades under this specification shall be run as indicated, as specified herein, as required by particular conditions at the site, as required to conform to the generally accepted standards and as required by all governing Building Codes so as to complete the work in a neat and satisfactorily workable manner. Run work parallel or perpendicular to the lines of the building unless otherwise noted.

C. The construction details of the building are illustrated on the Architectural and Structural Drawings. Be thoroughly acquainted with the details before submitting a bid as no allowances will be made because of unfamiliarity with these details. Place all inserts to accommodate the ultimate installation of pipe hangers in the forms before concrete is poured. Set sleeves in place in forms before concrete is poured, and in masonry walls while they are under construction.

D. The Electrical Contractor shall coordinate with the General Contractor, the requirements of all trades for temporary power during the construction phase. The Electrical Contractor shall provide the installation of temporary power distribution for those requirements as part of his work and at no additional cost to the owner.

E. The Contractor shall coordinate the interruption of service to the existing building with the Owner and shall bear all costs and be fully responsible for scheduling his work to accommodate all Owner activities at this facility. He shall also provide temporary electrical service to the existing electrical systems as necessary so that the Owner may have the use of undisturbed portions of the existing building.

1.5 INSPECTION OF SITE:

A. Visit the site, verify all existing items shown on plans, or specified, and be familiar with the working conditions, hazards, existing grades, actual formations, soil conditions, and local requirements involved; submission of bids shall be deemed evidence of such visit. All proposals shall take these existing conditions into consideration and the lack of specific information on the drawings shall not relieve the Contractor of any responsibility.

1.6 UTILITIES, LOCATIONS AND ELEVATIONS:

A. 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 and are offered separately from the Contract Documents, as a general guide only, without guarantee as to accuracy.

Examine the site, verify the locations, elevations, and availability of all utilities and services required, and be adequately informed as to their relation to the work; the submission of bids shall be deemed evidence thereof.

1.7 INSTRUCTIONS:

A. When specified in other Sections, the contractor shall furnish the services of competent instructors who will give full instruction to designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements of the equipment or system specified. Instruction shall be given during the first regular work week after the equipment or system has been accepted and turned over to the Owner for regular operation.

B. The number of man-days of instruction to be furnished shall be as specified in the various Sections of the Specification.

1.8 CODE REQUIREMENTS:

A. All work shall comply with the provisions of these specifications, as illustrated on the accompanying drawings, or as directed by the Architect, and shall satisfy the National Electrical Code and all applicable local codes, ordinances, or regulations of the governing bodies, and all authorities having jurisdiction over the work, or services thereto. In all cases where alterations to, or deviations from, the drawings and specifications are required by the authority having jurisdiction, report the same in writing to the Architect and secure his approval before proceeding. Upon completion of the work, furnish a statement from the inspecting authority stating that the installation has been accepted and approved. Provide complete utility service connections as directed, and submit, as required, all necessary drawings; secure all permits and inspections necessary in connection with the work, and pay all legal fees on account thereof. In the absence of other applicable local codes, acceptable to the Architect, the National Electric Code shall apply to this work.

1.9 MATERIALS AND WORKMANSHIP:

A. All materials unless otherwise specified shall be new, free from any defects, and of the best quality of their respective kinds. All like materials used shall be of the same manufacture, model, and quality unless otherwise specified.

B. All manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, adjusted, and conditioned as recommended by the manufacturers, or as indicated in their published literature unless specifically herein specified to the contrary.

C. All work shall be performed by competent workmen and executed in a neat and workmanlike manner providing a thorough and complete installation. Work shall be properly protected during construction, including the shielding of soft or fragile materials, and the temporary plugging of open conduits during construction. At completion, the installation shall be thoroughly cleaned and all tools, equipment, obstructions, or debris present as a result of this portion of work shall be removed from the premises.

1.10 COOPERATION:

A. All work under these specifications shall be accomplished in conjunction with other trades on this project in a manner which will allow each trade to complete his work in a timely fashion.

B. Maintaining contact and being familiar with the progress of the general construction and timely installation shall be the responsibility of this trade to expedite this contract and avoid unnecessary delays in the progress of other trades.

C. Should any question arise between the trades as to the placing of lines, ducts, conduits, fixtures, or equipment, or should it appear desirable to remove any general construction which would affect the appearance or strength of the structure, reference shall be made to the Architect for instructions.

1.11 DRAWINGS AND SPECIFICATIONS:

A. The drawings show diagrammatically the locations of the various conduits, fixtures, and equipment, and the method of connecting and controlling them. It is not intended to show every connection in detail and all fittings required for a complete system. The systems shall include, but are not limited to, the items shown on the drawings. Exact locations of these items shall be determined by reference to the general plans and measurements at the building and in cooperation with other trades and, in all cases, shall be subject to the approval of the Architect. The Architect reserves the right to make reasonable change in the location of this work without additional cost to the Owner.

B. Should any changes be deemed necessary in items shown on the contract drawings, the shop drawings, descriptions, and the reason for the proposed changes shall be submitted to the Architect for approval.

C. Lay out all work maintaining all lines, grades, and dimensions according to these drawings with due consideration for other trades and verify all dimensions at the site prior to any fabrication or installation; should any conflict develop or installation be impractical, the Architect shall be notified before any installation or fabrication and the existing conditions shall be investigated and proper changes effected without any additional cost.

D. Titles of Sections and Paragraphs in these specifications are introduced merely for convenience and are not to be construed as a correct or complete segregation or tabulation of the various units of material and/or work.

1.12 ARCHITECT'S APPROVAL:

A. In the statement under this contract where "approval" is required or requested, it is understood that such approval must be obtained from the Architect in writing before proceeding with the proposal, and an adequate number of copies of any such proposal shall be submitted to the Architect.

B. The approval of the Architect of any material, changes, drawings, etc., submitted will be considered as general only and to aid the Contractor in expediting his work. Such approval as

may be given does not in any way relieve the Contractor from the necessity of furnishing all materials and performing all work as required by the Drawings and Specifications.

1.13 LOCAL RESTRICTIONS:

A. Contractor shall become familiar with rules and regulations of the City, County, and State; or any other authority having jurisdiction over this project; and if, in his opinion, any work or materials shown on the drawings or specified do not comply with these rules and regulations as to size, type, capacity, and quality, he should make it known to the Architect prior to the submission of his bid.

1.14 ELECTRIC WIRING:

A. Except for such items as are normally wired up at the point of manufacture and so delivered, and unless specifically noted to the contrary herein, the Electrical Contractor shall do all electric wiring for power supply, including contactors, starters, etc. The other Contractors will erect all motors in place ready for connections. The Electrical Contractor shall mount all starters, as directed, furnishing supporting structures where necessary. The other Contractors will furnish with each item requiring electrical connections, the necessary instructions and wiring diagrams to this Sub-Contractor.

1.15 RESPONSIBILITY:

A. This Contractor will be held responsible for the satisfactory and complete execution of all work specified or indicated. He shall produce complete finished operating systems and provide all incidental items required as part of this work, regardless of whether such item is particularly specified or indicated.

1.16 HANGERS AND INSERTS:

A. All hangers, brackets, clamps, etc., shall be of standard weight steel. Perforated strap hangers shall not be used in any work. When two (2) or more conduits are run parallel, they may be supported on trapeze hangers. Other hangers shall be constructed with rods and hanger adjusters of adequate size to carry the loads imposed.

B. Unless otherwise shown on the drawings, all horizontal runs of conduit and piping shall be suspended from the floor or roof construction, as the case may be, by means of approved hangers spaced not farther apart than ten feet (10') on centers, except that hangers for piping 1-1/4" in size and smaller shall not be spaced more the 8 feet on centers. Vertical risers shall be supported by approved riser clamps or supports installed at the respective floor lines.

C. 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 Architect 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.

D. 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 parallel.

E. Above roof - Support conduit at no more than 8 feet on center, with manufactured pipe supports: Miro Industries Model 3-R to match existing supports on roof. The conduit supports shall be a roller-bearing type designed to support piping or conduit, and to absorb thermal expansion and contraction of piping or conduit thus preventing damage to roof membrane. The pipe or conduit shall rest on a polycarbonate resin roller and a glass- filled nylon rod situated in a polycarbonate resin seat.

1.17 GUARANTEE:

A. The entire system shall be guaranteed to be complete and installed in accordance with these plans and specifications.

B. Guarantee all new materials and workmanship for a period of one year from and after date of acceptance of installation. Replace, during the period of the guarantee, any parts found to be defective in their operation, without cost to the Owner.

C. Incandescent lamps shall be excepted from requirements of this guarantee, but all electric discharge and quartz lamps shall be covered under the guarantee.

1.18 REFERENCE ABBREVIATIONS:

A. References are made in the various electrical sections to technical societies, codes, specifications, trade organizations, and regulatory authorities in accordance with the following abbreviations:

1. FM - Factory Mutual
2. FS - Federal Specification
3. IEEE - Institute of Electrical and Electronics Engineers.
4. IPCEA - Insulated Power Cable Engineers Association
5. IRI - Industrial Risk Insurors
6. ISO - Insurance Services Organization
7. NEC - National Electrical Code(NFPA Pamphlet No. 70)
8. NEMA - National Electrical Manufacturer's Association
9. NFC - National Fire Codes
10. NFPA - National Fire Protection Association
11. UL - Underwriters Laboratories, Inc.

1.19 SHOP DRAWINGS AND DATA TO BE SUBMITTED:

A. SUBMITTALS WHICH DO NOT MEET THE FOLLOWING REQUIREMENTS WILL BE IMMEDIATELY REJECTED WITHOUT FURTHER REVIEW!

1. Catalog cutsheets and brochures will be preceded by a neatly arranged cover sheet having ample room for shopdrawing stamps and bearing the following information in a prominent, immediately visible location and size:

    a. Equipment name or number as referenced in the contract Documents (example: "AHU-A" or "Type A" light fixture).
    b. All options or accessories provided.
    c. Applicable Specification section and paragraph numbers.

2. Substitutions -

    a. Cross reference individual manufacturer and catalog numbers of substitute products to those of specified material.
    b. Prior to requesting permission to use substitute or alternate products, the Contractor shall investigate and make certain that the product-

        1) Conforms with the standard of performance and quality specified.
        2) Will physically fit in the space allocated, with sufficient access and maintenance space.
        3) Involves no additional costs to the Owner or extended construction time.

    c. Should the use of a substitute product entail any changes in details or construction, the changes and information documenting the complete coordination with all affected trades shall be submitted prior to submittal of substitute or alternate products
    d. Provide with requests for permission to use substitute or alternate products, drawings, specifications, samples, performance data and other information as may be required to assist in determination of acceptability of the product. The burden of proof is the Contractor's responsibility.

3. All similar or related items shall be submitted together under one cover sheet (i.e. fixtures, raceways, wiring, equipment). Do not piece-meal submittals!!!

B. Submittal Items:

1. Submit manufacturer's certified data relative to equipment required for the installation of the electrical and electronic systems.
2. Submit adequate engineering data on each piece of equipment to allow a careful check of compliance with the technical requirements of the Contract Documents. Clearly indicate on submittal data the manufacturer's name, piece number, equipment capacity, and other applicable technical data.
3. Equipment, Electrical Systems Submittals:

    a. New Power Distribution Equipment.
    b. Wiring Devices and Cover Plates.
    c. Lighting Fixtures.
    d. Fire Alarm Systems.
    e. Other Special Systems.

1.20 OPERATING AND MAINTENANCE MANUALS:

A. Bind in looseleaf binders with the words, "Operating and Maintenance Manual" and the Project identification imprinted on the cover. Prepare three complete sets of records for the Owner, with table of contents, index, and tabbed Section dividers.

B. During the construction period, accumulate the following for inclusion in the Operating and Maintenance Manuals-

1. Copies or warranties and guarantees on each piece of equipment installed.
2. Fixture brochures.
3. Wiring and Control Diagrams.
4. Approved Shop Drawings.
5. Operating instructions.
6. Recommended maintenance procedures.
7. Lists of major items of equipment with name, address, and telephone number of each local representative.

C. Submit the manuals for approval at approximately 75 percent job completion.

1.21 RECORD DRAWINGS:

A. Accumulate Record Drawings during the construction of the Project. Keep one set of blueline Contract Drawings at the job site at all times, and mark changes, rerouting or modifications which occur, clearly on the Drawings with dimensions.

B. At completion of the job, deliver Record Drawings to Architect. Record Drawings shall be submitted for approval prior to final payment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer's names and catalog numbers are scheduled or specified for the purpose of establishing standard of design, quality, appearance, performance and serviceability, and not to limit competition. Scheduled products (as may be modified by detailed specifications) are those selected as the basis for system design with respect to physical size and space arrangements, required capacity and performance characteristics, and the product quality intended.

B. The Drawings indicate specified products physically arranged in the spaces, as cataloged by specific manufacturers, generally as listed in the Equipment Schedules.

C. Listed "Acceptable Manufacturer's" are those considered capable of manufacturing products conforming to detailed Specifications, and as such, are invited to compete on an equal basis provided the offering is comparable in every respect to scheduled or specified products and actually conforms to the detailed Specifications and Schedule requirements. Listing herein as "acceptable manufacturers" does not imply "accepted", "approved", or "prior approval", or any other such connotation.

D. Vendors are invited to submit material or equipment bids to bidding Contractors on any comparable equivalent product, whether or not the manufacturer of such product is listed herein as an "acceptable manufacturer". Such product bids should clearly indicate offerings that are not listed as "acceptable manufacturer's". In the event a bidding Contractor, after satisfying himself that such unlisted product is in fact "equal" to the specified product with respect to design, quality, performance and arrangement (space requirements), and the Contractor desires to furnish that product on the Project, he may request the name of the manufacturer be added to the list of acceptable manufacturers by addendum prior to bid time.

E. At a bidder's request, an unnamed manufacturer's equipment will be considered to determine additional "acceptable manufacturers" if a request is made in writing no later than ten days prior to the bid opening. If such requests are found acceptable, an addendum will be written listing additional acceptable manufacturers. Consideration will be given only to requests of bona fide bidders (Contractors), not to those received from vendors.

F. Manufacturers of materials and equipment shall be as specified, scheduled, or as listed in each respective product Specification Article.

2.2 FLAME SPREAD AND SMOKE DEVELOPED PROPERTIES OF MATERIALS:

A. Materials and adhesives used throughout the electrical systems shall have a flame spread rating not over 25 without evidence of continued combustion and with a smoke developed rating not higher than 50. If such materials are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame spread rating not over 25 and a smoke developed rating not higher than 50. (Note: materials need not meet these requirements where they are entirely located outside of a building and do not penetrate a wall or roof, and do not create an exposure hazard or where specifically exempted in the body of these Specifications).

B. "Flame Spread Rating" and "Smoke Developed Rating" shall be as determined by the "Method of Test of Surface Burning Characteristics of Building Materials, NFPA No. 255, ASTM E84, Underwriters Laboratories, Inc., Standard". Such materials are listed in the Underwriters Laboratories, Inc. "Building Materials List" under the heading "Hazard Classification (Fire)".

2.3 SLEEVES AND ESCUTCHEONS:

A. Generally, where conduits pass through walls or floors, 22 gauge galvanized sheet iron sleeves shall be used, except those in beams, outside walls, or structural walls or members which shall be standard galvanized steel pipe. The size of these sleeves shall be such as to permit readily the subsequent insertion of conduit of the proper size with adequate clearance for movement due to expansion and contraction. Where conduits pass through outside walls, the inside diameter of the galvanized iron pipe sleeves shall be at least 1/2" greater than the outside diameter of the service pipe. After the conduits are installed, fill the annular space between the conduit and its sleeve with a mastic or caulk with lead. Use packing as required to accomplish this.

B. Sleeves in existing masonry load bearing walls shall be schedule 40 steel pipe grouted in place with structural grout. For exterior walls, the space between the pipe and the sleeves shall be packed with oakum or jute twine and calked watertight.

C. Escutcheons, except as specifically noted or specified, shall be installed on all conduits passing exposed through the floors, walls, or ceilings. Escutcheons shall be equal to the Crane No. 10 chrome plated sectional floor and ceiling plates and shall fit snugly and neatly around conduit. Solid chrome plates with set screws shall be used if sectional plates do not fit properly or stay in place.

2.4 FIRE STOPPING:

A. Seal annular spaces between sleeves and penetrating materials in fire rated floors, ceilings, and walls with fireproof and waterproof silicone elastomer applied in accordance with the manufacturer's published instructions. Multiple penetrations shall be sealed with silicone calking. Seal material shall be UL classified for use in fire rated penetration seals, and shall be applied in the manufacturer's recommended thickness for the fire rating of the penetrated structure in accordance with ASTM-E-814 requirements.

B. Acceptable Manufacturers - Dow Corning, General Electric, Hilti.

2.5 WATERPROOFING:

A. Seal penetrations of wet or potentially wet structures, floors, exterior walls, etc., other than those requiring fire stopping, with sealant to prevent moisture leakage. Apply sealing material (calking) in accordance with manufacturer's published instructions.

B. Product Research and Chemical Co. "Poly-Sulphide Sealant" PRC- 5000.

2.6 CABINETS:

A. Provide cabinets where indicated and where necessary.

B. Provide flush type in finished areas centered in paneling and other Architectural features.

C. Provide surface type in equipment rooms, above accessible finished ceilings, and in crawl spaces.

D. Install lighting and power cabinets with tops 6 feet 6 inches above finished floor.

E. Cabinets for Panelboards shall be of same manufacturer as panelboard interiors. Cabinets for timeclocks, contactors and other electrical equipment supplied under this division may be of other manufactures complying with NEMA, UL and nec requirements. All boxes shall be code gauge steel, welded with edges turned to receive trim, and galvanized. Trim and doors shall be No. 12 gauge steel minimum, hinged door, flush tumbler lock and catch keyed alike throughout the work, factory enamel finish, suitable for field color coat. For flush panels provide covers with overlap minimum 3/4 inches top, bottom, and sides. For surface mounted panels covers shall be same size as cabinet.

F. Identify all cabinets for all panelboards, switchboards, disconnect switches, transformers, motor starters, and electrical equipment furnished shall be provided with engraved phenolic lamacoid

plastic name plates with 1/2 inch block engraving. Name plates shall give equipment designation as scheduled on the drawings and voltage and phase of service.

2.7 GROUNDING:

A. Provide grounding of electrical system in accordance with the National Electrical Code NFPA 70, UL 467, and IEEE 837 for grounding and bonding materials and equipment.

1. Equipment grounding conductors shall be sized in accordance with the National Electrical Code Equipment Grounding Conductor Table on the basis of the circuit overcurrent protection device rating.
2. Bond together the following items to serve as a single grounding electrode for all electric services:

    a. Minimum 20 feet BHD copper conductor encased in concrete footing or grade beam in contact with earth.
    b. Structural steel building framework.
    c. 10'-0" X 3/4" diameter copper-clad steel ground rod(s).

        1) Where more than one ground rod is required to meet specified resistance, ground rods shall be located at least 10 feet apart. Interconnect with grounding electrode conductor below grade unless otherwise indicated.

    d. Metal underground water pipe.

3. The grounding electrode shall be connected by a grounding electrode conductor sized in accordance with the National Electric Code Table 250-94 to the service neutral bus.
4. Provide a main bonding jumper from the grounded service neutral bus to the main equipment ground bus or point of termination of the equipment grounding conductors.
5. Provide bonding jumpers for attachment of each metallic water, fuel, fire suppression, steam, gas or air piping system to the building grounding electrode system. Provide connections with listed connectors applied to the piping in an approved method. The points of attachment of the bonding jumpers shall be accessible. The bonding jumper size shall match the main grounding electrode conductor.
6. Grounding system resistance must not exceed 5 ohms. Final tests shall be conducted to ensure that this requirement is met.

B. Provide equipment grounding conductors for all circuits. A green insulated, copper ground conductor shall be installed with all circuits so as to make an electrically continuous ground system.

C. Ground all non-current carrying equipment, such as cable tray and equipment structures.

D. Grounding Connectors:

1. Listed and labeled by a NRTL acceptable to the authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
2. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
3. Welded Connections:

a. Exothermic welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
b. For structural steel, steel grounding stud for compression connector.

4. Compression Connectors: Hydraulic crimped, irreversible compression type kits. Connectors shall be factory filled with oxide inhibitor. All crimps shall be made with a hydraulic tool that embosses the index number on the outside of the connector. Compression type connections shall be allowed above and below grade where any permanent connection is required.
5. All splices and grounding electrode connections shall be made with exothermic welds or with hydraulic compression fittings.

E. Field Quality Control

1. Inspect grounding and bonding system conductors and connections for tightness and proper installation. Inspect compression type connections for proper die index number embossment.
2. Perform the following testing:

a. After installing grounding system, but before permanent electrical circuits have been energized, test for compliance with requirements.
b. Test completed grounding system as each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at ground rods. Make tests at ground rods before any conductors are connected.
c. Measure ground resistance no fewer than two full days after the last trace of participation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
d. Perform tests for fall-of-potential method according to IEEE 81. Submit test results to the Engineer.
e. If resistance to ground exceeds specified values, promptly notify Engineer and include recommendations for reducing ground resistance.

2.8 IDENTIFICATION:

A. Provide engraved phenolic lamacoid plastic name plates with 1/2 inch block engraving. Name plates shall give equipment designation as scheduled on the drawings.

B. After balancing branch circuits, provide each breaker panel with a typed directory which identifies specifically the branch circuit loads and location. Use architectural room names and designations found on the Contract Documents.

C. Provide labels for fused switches indicating equipment served and unit capacity in horse power or full load amperes and the installed fuse rating.

2.9 WIRE AND CABLE:

A. Provide systems of wires and cables for electric power, signalling, and control.

B. Materials:

1. Conductors shall be soft drawn annealed, conductivity of 98% pure copper. No. 10 AWG and Smaller: Solid copper. No. 8 AWG and Larger: Stranded copper.
2. Other: Pull Cords - 1/8" nylon. Pulling Compound - Ideal "Yellow 77".

C. Install Wire Types:

1. THHN/THWN, XHHW for light and power branch circuits and control wiring.
2. THHN/THWN, XHHW for feeders, sub-feeders, motor circuits and high ambient temperature locations.

D. Consistently color code wiring continuous throughout the work with insulation factory color-coded by pigmentation.

1. 120/208 Volt Systems:

a. Phase A - Black
b. Phase B - Red
c. Phase C - Blue
d. Neutral - White
e. Ground - Green

2. 277/480 Volt Systems:

a. Phase A – Brown
b. Phase B - Orange
c. Phase C - Yellow
d. Neutral - Gray
e. Ground - Green

3. Switch legs, travelers, and special systems continuous throughout the work as selected by the Contractor.
4. Where factory colors are not available, code ends of conductors with 1-1/2 inch colored tape.

E. Circuits of multiple phases passing through enclosures shall have phases grouped to reduce the reactance effect.

F. Minimum Sizes:

1. Light and Power Branch Circuits, 15 and 20 amperes OCP:

a. Minimum branch circuit: No. 12 AWG
b. 120V longer than 80 feet first outlet to panel: No. 10 AWG.
c. 120V longer than 120 feet from first outlet to panel: No. 8 AWG
d. 277V longer than 130 feet from first outlet to panel: No. 10 AWG.
e. 277V longer than 220 feet from first outlet to panel: No. 8 AWG.

2. All branch circuits shall have dedicated full ampacity neutrals, or shared neutral conductors serving two or three branch circuits shall be sized at 175% of the maximum

branch circuit overcurrent device, based on the 75°C ratings in Table 310-16 of the National Electrical Code. Shared neutral conductors shall be considered as current-carrying conductors for the purpose of derating conductor ampacities for installation of more than three current- carrying conductors in a raceway or cable.

3. Other circuits sized to limit voltage drop per National Electrical Code.
4. Control Wiring: No. 14 AWG, unless otherwise specified.

G. Acceptable Manufacturers - American Inslated Wire Corp., Cablec Corp., Cerrowire, Essex, Guardian, Rome Cable, Triangle.

2.10 OUTLET BOXES:

A. Provide outlet boxes for the installation of wiring devices, lighting fixtures, fire alarm devices and power and control connections. Provide boxes at the terminal of conduit runs to outlets and devices and for installation of conductors as required by the NEC.

B. Locate switch boxes at locations designated by Architectural Documents when indicated. If Architectural locations are not identified use appropriate locations consistent with schematic indications on Electrical Documents. Where application of switches repeats installation type and relative locations shall be consistent throughout project unless indicated otherwise.

C. Provide standard manufactured plugs in unused openings of boxes. Provide plaster rings and covers where required by the building structure. Rigidly attach boxes to structure and ceiling supporting members in suspended ceilings to avoid cutting mechanical ceiling members.

D. Materials: Metallic boxes shall be of welded or one piece cast construction.

1. Flush Mounted Outlet Boxes: Standard, stamped galvanized steel with factory conduit knockouts, one piece and welded construction.
2. In dry walls for single and two gang outlet provide 4S and 4D boxes, for 3 or more outlets use masonry boxes.
3. In block and masonry walls provide masonry boxes of depths required for wall thickness.
4. In ceilings provide 4 inch boxes. Omit covers if standard canopy and device plates entirely cover the ceiling opening.
5. In exposed work, exterior of the building, in wet locations, and flush in non-waterproofed walls below grade provide FS and FD boxes.
6. Unless instructed otherwise on drawings, for telephone and data outlets, provide empty flush mounted wall box with 3/4-inch conduit in wall to accessible ceiling space.
7. See scheduled flush floor boxes on drawings.

E. Location: Install center of box at heights above finished floor unless other directions are indicated in Contract Documents:

1. Wall Switches: 47 Inches
2. Convenience Outlets: 18 Inches
3. Telephone/Data Outlets: 18 Inches
4. Boxes Indicated Above Counters (CT): 6 Inches above backsplash and trim, unless otherwise indicated.

F. Do not use through-the-wall and back-to-back boxes.

2.11 WIRING DEVICES:

A. Samples: Provide two samples of each type and color of wiring device and respective cover plate utilized in the project. Provide other samples upon specific request for typical NEMA devices. Colors of all exposed devices shall be as herein specified, and shall be submitted for final approval by Architect.

B. Cover Plate and Wiring Device colors:

1. Finished areas: Grey devices with stainless steel cover plates.
2. Maintenance and equipment rooms: Grey devices and galvanized steel coverplates.

C. Cover Plates for Telephone and Data Boxes: Blank, brushed stainless steel, unless otherwise noted on plans.

D. Weatherproof Cover Plates: Corrosion resistant finish metal plate, die cast cover, and gasket.

E. Cover Plates for Surface Mounted Outlet Boxes: Zinc coated sheet steel rounded edges, same size as outlet box.

F. Wiring Device Schedule (Based on Leviton Specification Grade) -

1. Standard duplex receptacle - 125V, 20A, NEMA 5-20: #5352.
2. Special receptacles - type and NEMA configuration as indicated on drawings.
3. Ground fault circuit interrupting duplex receptacle - 125V, 20A, NEMA 5-20: #6898.
4. One pole wall toggle switch - 120/277V, 20A: #1221-2.
5. Two pole wall toggle switch - 120/277V, 20A: #1222-2.
6. Three-way wall toggle switch - 120/277V, 20A: #1223-2.
7. Four-way wall toggle switch - 120/277V, 20A: #1224-2.
8. Special switches - As indicated on plans.
9. Acceptable Manufacturers - Eagle, Hubbell, Leviton, Pass and Seymour.

2.12 CONDUITS:

A. Provide a mechanically and electrically complete conduit system.

B. Rigid Metal Electrical Conduit: Hot-dipped galvanized steel with zinc coated threads and an outer coating of zinc bichromate, complete with one coupling and one end thread protector.

C. Intermediate Metal Conduit: Hot-dipped galvanized steel, complete with one coupling and one end thread protector.

D. Electrical Metallic Tubing: Welded, electro-galvanized thin wall steel tubing.

E. Flexible Metal Electrical Conduit: Hot-dipped galvanized steel strip core with integral copper ground wire on sizes 1-1/4" and smaller.

F. Liquidtight Flexible Metal Electrical Conduit: Hot-dipped galvanized steel strip core with extruded polyvinyl jacket, O-Z Gedney Type UAG.

G. Rigid Nonmetallic Electrical Conduit: Schedule 40 heavy wall polyvinylchloride, high impact resistant.

H. Elbows and Bends:

1. For rigid nonmetallic conduit systems, use rigid metal electrical conduits.
2. For other conduit systems, use same material as the conduit with which they are installed.
3. For all types, size 1-1/4 inch and larger shall be factory manufactured.

I. Bushings:

1. 1-1/4" and Smaller: Same material as the conduit with which they are installed.
2. 1-1/2" and Larger: Hot-dipped galvanized with thermosetting phenolic insulation, 150 Deg.C., O-Z/Gedney Type "B".

J. Locknuts:

1. 1-1/2" and Smaller: Zinc plated heavy stock steel, O- Z/Gedney.
2. 2" and Larger: Cadmium plated malleable iron, O-Z/Gedney.

K. Hubs: Cadmium plated malleable iron, tapered threads, neoprene "O" ring, insulated throat, O-Z/Gedney.

L. E.M.T. Fittings:

1. Compression Connectors and Couplings: Gland compression type, die cast zinc body, malleable iron nut, insulated throat, O-Z/Gedney, Raco, Red Dot.
2. Set Screw Connectors and Couplings: Die cast zinc body, single set screw for 1/2" - 1" sizes, two set screws for 1 1/4" - 4" sizes, O-Z/Gedney, Raco, Red Dot.

M. Liquidtight Conduit Connectors: Cadmium plated malleable iron body and nut, cadmium plated steel ferrule, insulated throat, integrally cast external ground lug, O-Z/Gedney Type 4QL.

N. Seals for Wall and Floor Penetrations: Malleable iron body, oversize sleeve, sealing ring, pressure clamp and rings and sealing grommet, hex head cap screws, O-Z/Gedney Type FSK.

O. Fire Seals: Heat activated intumescent material, elastomeric sealing ring, socket head cap screws, steel pressure discs and flange, O-Z/Gedney Type CFSF.

P. Expansion Fittings: Hot-dipped galvanized malleable iron with bonding jumpers.

Q. Escutcheons: Chrome plated sectional floor and ceiling plates, Crane No. 10.

R. Accessories: Reducers, bushings, washers, etc., shall be cadmium plated malleable iron on the forms and dimensions best suited for the application.

S. Size conduits as indicated on the drawings and as required by the NEC for the number and sizes of wires to be drawn into conduit. Do not use conduit sized less than 3/4" unless specified otherwise.

T. Conceal conduits from view in all areas except mechanical and electrical equipment rooms, attics and crawl spaces.

1. Should it appear necessary to expose any conduit, bring specific information to the attention of the Architect immediately, and rearrange the work to facilitate an approved installation.
2. Where conduits must be exposed in finished areas, utilize paintable surface mounted vinyl or metal raceways, fittings and boxes equivalent to Wiremold or Hubbell. No exposed circuitry shall be installed in finished spaces without prior approval of Architect.

U. Installation:

1. Install all conduits at elevations and locations to avoid interference with grading of other work, the structure, finished ceilings, walls. Avoid causing cutting of masonry units.
2. Install conduits before concrete is placed, and in advance of masonry work. Run conduits imbedded in structural slabs in the middle of the slab below the top and above the bottom reinforcing steel. Maintain a minimum 1-1/2" cover except where penetration is made. Do not install conduit larger than 1" in slabs.
3. Install conduits through roof in time to be flashed prior to roofing application.
4. Cap or plug conduits with standard manufactured accessories as soon as the conduits have been permanently installed in place.
5. Where space conditions prohibit the use of standard ells, elbows, and conduits, use cast ferrous alloy fittings of such forms and dimensions as best required for the application.
6. Make all conduit joints mechanically tight, electrically continuous, and watertight. Pitch conduits in a manner to avoid creating moisture traps.
7. Connect and couple E.M.T. with compression or set screw type fittings. Do not use indentor fittings.
8. Install and neatly rack exposed conduits parallel with and perpendicular to the building walls. Do not install exposed diagonal conduit runs.
9. Do not run conduits exposed on the roof unless approval is obtained prior to installation.
10. Do not place conduits in close proximity to equipment, systems, and service lines, such as hot water supply and return lines, which could be detrimental to the conduit and its contents. Maintain a minimum 3" separation, except in crossing, which shall be a minimum 1".
11. Connect motors, equipment containing motors, equipment mounted on an isolated foundation, transformers, and other equipment and devices which are subject to vibration and which require adjustment with flexible metallic conduit from the device to the conduit serving it. Size the flexible conduit length more than 12 diameters, but less that 18 diameters. Rigidly support the points of attachment on each side of the connection. Use external bonding jumpers on sizes 1-1/2" and above.
12. Install escutcheons on all exposed conduits passing through interior floors, walls, or ceilings. Install fire seals on all conduits passing through fire rated partitions. Install wall and floor fire seals on all conduits passing through exterior walls and floors, or use standard galvanized steel pipe sleeves; diameters 1/2" greater than the outside diameter of the sleeved conduit and fill the annular space with mastic.
13. Install rigid metal electrical conduit for feeders and sub-feeders, and for all used in damp and wet locations and in hazardous areas.
14. Install electrical metallic tubing for branch circuits concealed in walls and above ceiling for size 2" and smaller.

15. Install rigid non-metallic conduit with manufactured spacers for feeders and branch circuits run underground exterior to the building, or underground and beneath the building, or where specifically noted. Use rigid metal conduit long radius sweeps for offsets and changes in direction. Use rigid metal conduit for risers and where exposed above slab or grade.
16. Install flexible metal conduit where specified above and where permitted by the authorities having jurisdiction for final connections to lighting fixtures which have isolated junction boxes. Use liquid-tight flexible conduit for exterior applications, in damp and wet locations.
17. Install pull cords in all empty raceway systems, tagged with the identification of service intended and location of opposite end.

2.13 ACCESS DOORS:

A. Furnish, for installation under appropriate Section of the Work, access doors at each point required to provide access to concealed valves, dampers, damper operators, and other devices requiring operation, adjustment, or maintenance.

B. Shall be 16 gage steel, with mounting straps, concealed hangers, and screwdriver locks, designed for the doors to open 180 degrees, minimum.

C. Access doors installed in fire walls or partitions shall be UL labeled to maintain surfaces.

D. Provide prime coat finish for installation in ceilings or painted or unfinished surfaces.

E. Provide polish chrome plate finish for installation in unpainted finished walls.

F. Acceptable Manufacturers - Baldwin, Hannon, Josam, Miami, Carey, Milcor, Titus, Wade, Walsh, Zurn.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT:

A. Protect equipment from physical damage and deterioration after it is delivered to the Project, and during the installation period prior to Owner acceptance. Repair scratches, mars, or paint deterioration.

3.2 EQUIPMENT SPACE:

A. The Drawings indicate specified products physically arranged in the spaces, as cataloged by specific manufacturers, generally as listed in the Equipment Schedule.

B. Coordinate the exact physical space requirements for equipment and servicing of equipment actually purchased for each item of equipment involved.

C. Keep horizontal lines as close to ceiling as practicable.

D. Adhere to Drawings as closely as possible in layout of work.

E. Vary run of conduits and make offset during progress of work as required to meet structural and other interferences.

F. Install conduits in furred spaces wherever possible. Run exposed conduits parallel to or at right angles to buildings walls.

G. Conform to ceiling heights established on architectural construction drawings.

3.3 INTERFERENCES:

A. Relocate or reroute existing conduit, wiring, or equipment as required to facilitate construction of finished work as planned. Restore surfaces, insulation, and finish to match condition of adjacent work.

3.4 CUTTING AND PATCHING:

A. Assume costs and responsibility for cutting and patching required to complete the installation. Patching shall be finished to match adjacent surfaces to the satisfaction of the Architect.

3.5 PAINTING AND FINISHING AND CLEANING:

A. Provide touchup painting of prefinished electrical products.

B. Surfaces shall be left clean and debris shall be removed.

C. Clean all light fixture lenses, lamps and reflectors.

3.6 OPTION TO RELOCATE OUTLETS AND RELATED DEVICES:

A. Electrical outlets and light fixtures may be relocated at the Owner's option to points within 10-feet of their indicated locations, at no additional cost to the Owner, provided the Contractor is notified prior to roughing-in and fabrication.

B. Only work which must be reperformed in this connection will be considered extra.

3.7 TESTS AND LOAD BALANCING:

A. Test all circuits to assure them to be free of grounds. Prove and test energy available at the load side of disconnect switches and the final point of connection to driven equipment. Make all reasonable tests as required by the Architect to provide the integrity of the work and leave the complete electrical installation in first class condition and ready for operation.

B. Balance the load on each phase when connecting the various branch circuits in each panel board. When all load is turned on and the system is in operation at 100% demand, the initial unbalance shall not exceed 10%.

C. Furnish at the completion of the job, a final inspection certificate from the local inspecting authority.

3.8 ELECTRICAL DISCONNECTS:

A. Provide disconnects where indicated and where required by the National Electrical Code. Install within sight of electrified equipment served and provide final connection to equipment served.

B. Provide switch sizes as required by the National Electrical Code based on the equipment actually furnished under other Divisions or provided by the Owner.

C. Provide NEMA 1 enclosure indoors, NEMA 3R enclosure exterior, in damp or wet locations and in crawl spaces, flush and surface as specified for outlet boxes.

3.9 EQUIPMENT CONNECTIONS:

A. Provide wiring for the connection of motors and control equipment and control wiring as indicated on the Electrical Drawings.

1. Equipment installed under Other Sections - wiring shall be extended to the equipment, and proper connections made thereto.
2. Flexible connections of short lengths - shall be provided for equipment subject to vibration or movement and for motorized and compressor equipment. Liquid-tight conduit shall be used in wet locations. A separate ground conductor shall be provided across flexible connections.

3.10 EXCAVATION AND BACKFILLING:

A. Provide necessary excavating and backfilling for the installation of work specified in this Division. Trenches for underground conduits shall be excavated to required depths as necessary to insure uniform bearing. Care should be taken not to excavate below depth, and any excavation below depth shall be refilled with sand or gravel firmly compacted. Where rock or hard objects are encountered, they shall be excavated to a grade six inches (6") below the lowermost part of the raceway and refilled to the raceway grade as specified. After the raceway has been installed, tested, and approved, the trenches shall be backfilled to grade with approved material, in 12 inch layers wetted and compacted to density of adjacent soil. Complete backfill to grade to result in a well compacted trench to 95% compaction by the standard Proctor test. Where streets, sidewalks, etc., are disturbed, cut, or damaged by this work, the expense of repairing same in a manner approved by the Architect shall be a part of this work.

END OF SECTION 26 01 00

SECTION 26 16 00 - POWER DISTRIBUTION EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Provide distribution panelboards, branch circuit panelboards, motor control centers, transformers and power factor correction equipment, as scheduled and specified for the electrical distribution system.

1.2 QUALITY ASSURANCE:

A. Source Quality Control: Tests to meet applicable standards of the following:

1. Underwriters' Laboratories.
2. National Electrical Manufacturer's Association.
3. National Electrical Code.
4. American National Standards Institute.

1.3 SUBMITTALS:

A. Submit shop drawings in accordance with other Sections. Include layouts showing cabinet dimensions, conduit entrances, electrical ratings, bussing connections, single line diagrams, device locations and ratings, and cable termination provisions.

B. Certificates:

1. Labels of Underwriters' Laboratories affixed to each item of material.
2. Label of Underwriters' Laboratories approval for service entrance use, where applicable, affixed to material.

C. See section 26 01 00.

PART 2 - PRODUCTS

2.1 POWER DISTRIBUTION EQIUPMENT:

A. Branch Circuit Panelboards:

1. Equivalent to Square D Type NQ and NF, all bussing - copper.
2. Single phase, 3 wire, and 3 phase, 4 wire, solid neutral design with sequence bussing and full capacity neutral.
3. Provide scheduled circuit breakers, minimum 10,000 A.I.C. for 208 volt and 14,000 for 480 volt.

4. Provide feed thru lugs where extension of primary feeders is required.
5. Provide cabinets of NEMA type appropriate for application.
6. Provide isolated ground bus where scheduled.

B. Circuit Breakers:

1. Resettable, quick-make, quick-break, thermal magnetic type, ambient compensated, trip free with separate trip position from on and off positions.
2. Multiple pole breakers with common trip and one operating handle. Do not provide handle ties.
3. 15 and 20 ampere, single pole circuit breakers shall be U.L. listed as switching duty rated.
4. Wire with sequence phasing.
5. Provide circuit breakers of appropriate capacity for all unscheduled circuits.
6. For panelboards rated 600 amperes or greater, provide bolt- on type circuit breakers.
7. Provide U.L listed HACR circuit breakers for compressorized equipment loads where the circuit breaker serves as the final overcurrent protection.
8. Where indicated on the panel schedule, provide panel mounted power supply to provide 24 volts DC switching power for remote controlled circuit breakers.
9. Breakers indicated to be "Remote Controlled":

    a. Circuit breakers shall be UL Listed and rated 120/ 240Vac (1- and 2-pole) and 240Vac (3-pole) with continuous current ratings as shown on the plans.
    b. Circuit breakers shall have an overcenter, trip-free, toggle type, quick-make/quick-break mechanical action and positive handle indication. Handle shall have on, off, and tripped positions. In addition, trip indication shall include a trip indicator on the face of the breaker case.
    c. Multi-pole breakers shall have internal crossbars for common trip operation.
    d. Circuit breaker contacts shall be open when breaker is in the OFF or "tripped" position regardless of remote signal.
    e. Interrupting capacity shall be 10,000 rms symmetrical amperes.
    f. 15A and 20A breakers shall be SWD rated.
    g. Multipole circuit breakers rated 15-60A shall be UL Listed for HACR applications.
    h. All circuit breakers shall have contacts suitable for use on HID lighting systems.
    i. Circuit breakers shall be marked "Remote Controlled" in such a way that the marking is visible with the trim installed.
    j. Circuit breakers shall have terminals suitable for use with AI/Cu 75°C wire.
    k. Circuit breakers shall be capable of operating for 30,000 operations at rated voltage and current with an 80% lagging power factor.
    l. Remote-control shall be accomplished via a 24Vdc high speed motor with clearing switch that clears the motor circuit upon circuit breaker contact opening or closing.
    m. Motor shall operate no more than 50 milliseconds at rated voltage (24Vdc) ±10% and draw no more than 2A instantaneous. Maintaining the control signal shall have no adverse effect on the breaker.

C. Enclosed Circuit Breakers:

1. Equivalent to Square D LHL, MHL and PJL.
2. 3 phase, 4 wire, solid neutral design with sequence bussing, copper and full capacity neutral unless scheduled otherwise.

3. 65,000 Amp., R.M.S. minimum interrupting rating, or as scheduled on drawings.
4. Provide dual rated lugs for supply and load conductors.
5. Provide cabinets of NEMA type appropriate for application. Outdoor enclosures shall be equipped with factory installed means to padlock door.
6. Weather proof hubs and threaded conduit connections shall be used for outdoor circuitry.
7. Provide ground bus unless noted otherwise.

D. Dry Type Transformers:

1. Two windings of the size and electrical characteristics as scheduled.
2. Guaranteed sound levels shall not exceed ANSI standard decibel levels. Transformers shall be rated at full load in a 40°C ambient with 30°C ultimate hot spot temperature rise allowance, with Class F insulation having a UL 185°C rating limiting system temperature to 115°C on 25 kVA and smaller units, and Class H insulation having a UL 220°C rating limiting system temperature to 150°C on 30 kVA and larger units.
3. The maximum temperature rise of the top of the enclosure shall not exceed 35°C over a 40°C ambient.
4. Transformers rated at 30 kVA and above shall have core and coil assembly completely isolated from enclosure with neoprene rubber pads, and six primary voltage taps rated (4) 2-1/2 percent normal and (2) 2-1/2 percent above normal. Transformers rated at 25 KVA and below shall have four primary voltage taps rated (2) 2-1/2 percent below normal and (2) 2-1/2 percent above normal.
5. Make necessary tap adjustments on transformers to insure that the secondary voltages at the transformer terminals will be as close as possible to 120 volts phase-to-neutral, and 208 volts phase-to-phase, when the building is in normal operation.
6. Transformers shall have heat barriered termination compartment arranged for feeder terminations for side or bottom entrance of flexible metallic raceways.
7. Transformers shall have a bonding jumper installed between the secondary neutral terminal and the metal case and shall include a ground terminal of proper size to receive ground conductor.

E. Acceptable Manufacturers – Eaton, General Electric, Siemens, Square D.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Carefully measure and lay out exact locations of equipment in conference with the Construction Manager.

B. Assure that equipment may be installed without adversely affecting the integrity and appearance of the building structure and with the clearances required by the National Electrical Code.

3.2 INSTALLATION:

A. Provide panelboards of the types and ratings scheduled where indicated.

B. Provide flush and surface mounted types where indicated and scheduled.

1. Provide multi-section cabinets as required and scheduled; one-piece covers and doors, main and sub-feed lugs as required.
2. Provide hinged doors with flush tumbler lock and catch, all locks keyed alike.
3. Provide 3 keys for each panelboard.

C. Provide supports to the building structure, independent of raceways.

D. Install tops of panelboard cabinets at 6 feet, 6 inches, above finished floor.

E. Install panelboards in cabinets, centered in door openings.

F. Provide Identification:

1. For Panelboards - Engraved, lamacoid plastic name plate, giving equipment designation.
2. For Distribution and Branch Circuit Panelboards: - Neatly typewritten circuit directory in cardholder inside panelboard door.

    a. For Branch Circuit Panelboards: Identify rooms served using room numbers corresponding to those finally established at the project.
    b. For Distribution Panelboards: Identify the equipment served and give circuit designation.
    c. For motor starters identify equipment designation as scheduled on the drawings, voltage and phase of service, and the source of power.

G. Provide Vibration Isolation for Suspended Transformers:

1. Provide spring hangers, equivalent to Mason Type PC30, 1" deflection, consisting of a rectangular steel box, coil spring, spring cups, neoprene impregnated fabric washer, and steel washer, with an elastomeric element at the top of the box for acoustic isolation. The design shall be such as to prevent metal-to-metal contact between the hanger rod and the top of the hanger box. The elastomeric element shall be designed for approximately 1/4-inch deflection and loaded so that deflection does not exceed 15 percent of the free height of the element.
2. Install the isolators with the isolator hanger box as close as possible to the structure.
3. Suspend the isolators from the building structure, never from slab diaphragms between beams.

3.3 FIELD QUALITY CONTROL:

A. Perform manufacturer's recommended field tests prior to energization.

B. Provide copies of test results to the Owner's representative.

END OF SECTION 26 16 00

SECTION 26 17 00 - MOTOR AND CIRCUIT DISCONNECTS

PART 1 - GENERAL

1.1 SCOPE

A. Provide disconnect switches for branch circuit, motor circuits, and all items of equipment in conformance with the National Electric Code.

1.2 QUALITY ASSURANCE

A. Source Quality Control: Tests to meet applicable Underwriters' Laboratories, Inc. Standards, the National Electrical Manufacturer's Association and the National Electrical Code.

1.3 SUBMITTALS

A. Submit shop drawings in accordance with other Sections. Include enclosure dimensions, type, electrical ratings, fuse provision, installation instructions, and name plate nomenclature.

B. Certificates:

1. Labels of Underwriters' Laboratories, Inc. affixed to each item of materials.

C. See Section 26 01 00.

1.4 JOB CONDITIONS:

A. Provide switch sizes as required by the National Electrical Code based on the equipment actually furnished under other Divisions or provided by the Owner.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. For single phase motors under 1/2 horsepower: Equivalent to Square D Class 2510 Fractional Horsepower single phase two pole manual starter with toggle type switch, locking attachment, neon pilot light, thermal overload elements sized per motor name plate rating and NEMA 1 enclosure indoors, NEMA 4 enclosure exterior, in damp or wet locations and in crawl spaces, flush and surface as specified for outlet boxes.

B. For single and three phase motors, 120, 230, 480 volts, 1/2 to 3 horsepower, requiring manual starters: Equivalent to Square D Class 2510 Integral Horsepower manual starter with toggle type switch, low voltage protection, pilot light, thermal overload elements sized per motor name plate rating with number of poles required for specific application and NEMA 1 enclosure indoors, NEMA 3R enclosure exterior, in damp or wet locations and in crawl spaces, flush and surface as specified for outlet boxes.

C. For Other 250 Volt Equipment: Equivalent to Square D Class 3130 NEMA Type GD Safety Switches, fusible and non-fusible as required by NEC with cover interlocks, with NEMA cabinet required for application, with threaded hubs.

D. Acceptable Manufacturers - Cutler Hammer, General Electric, Siemens ITE, Square D.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect building structure to which disconnects are to be secured for defects which affect the execution and quality of work.

B. Do not start work until defects are corrected.

3.2 PREPARATION

A. Carefully measure and lay out exact locations maintaining working clearances required by the National Electrical Code.

3.3 INSTALLATION

A. Provide disconnects where indicated and where required by the National Electrical Code.

B. Install within sight of equipment served.

C. Provide final connection to equipment served.

D. Provide name plate secured to cabinet with designation of equipment served, operating voltage, and circuit designation.

3.4 EQUIPMENT CONNECTIONS

A. Provide wiring for the connection of motors and control equipment and control wiring as indicated on the Electrical Drawings.

1. Equipment installed under Other Sections - wiring shall be extended to the equipment, and proper connections made thereto.
2. Flexible connections of short lengths - shall be provided for equipment subject to vibration or movement and for motorized and compressor equipment. Liquid-tight conduit shall be used in wet locations. A separate ground conductor shall be provided across flexible connections.

    a. Length of flexible connections for motors shall be at least 11-inches plus 1/4-inch per horsepower up to 100 hp, and need not be longer than 36-inches unless otherwise indicated.
    b. Length of flexible connections for transformers shall be at least 11-inches plus 1/4-inch per KVA up to 100 KVA, and need not be longer than 36-inches unless otherwise indicated.

3. Power connections to any vibration isolated equipment shall be made with a length of flexible conduit having a 90 degree bend in it between the junction box on the equipment and any non-flexible conduit.
4. Owner furnished equipment - wiring shall be extended to the equipment, and proper connections made thereto.

END OF SECTION 26 17 00

SECTION 26 50 00 - LIGHTING

PART 1 - GENERAL

1.1 WORK INCLUDED:

A. Conditions of the Contract and General Requirements are hereby made a part of this section.

B. Provide lighting fixtures, lamps, and accessories for interior and exterior illumination of the building.

1.2 QUALITY ASSURANCE:

A. Manufacturers: Exceptions to manufacturers listed with each item shall be made in accordance with the General Requirements.

B. Laboratory Testing: Photometric testing shall be by Independent Testing Laboratories, Inc., based on Illuminating Engineering Society published procedures, and shall include candlepower distribution tabulation and zonal cavity coefficient of utilization tabulation.

C. Standards:

1. All lighting fixtures shall meet Underwriters' Laboratories, Inc., applicable standards.
2. Fixtures shall be provided possessing Underwriters' Laboratories location duty listings as required by the specific application.

    a. Exposed Outdoors - Wet Location
    b. Sheltered Outdoors - Damp location

D. NEC Compliance: Comply with the NEC as applicable to the installation and construction of lighting fixtures.

E. NEMA Compliance: Comply with applicable requirements of NEMA Standard Pub. Nos. LE-1 and LE-2 pertaining to lighting equipment.

F. ANSI/UL Compliance: Comply with ANSI/UL Standards pertaining to interior and exterior lighting fixtures for hazardous locations.

G. UL Compliance: Provide light fixtures that have been UL listed and labeled.

1.3 SUBMITTALS:

A. Submit manufacturer's literature giving materials, finishes, dimensions, coefficients of utilization, and lamp types for each fixture which is the product of one of the listed acceptable manufacturers.

B. Submit samples of fixtures upon specific request.

C. See Section 26 01 00.

1.4 CERTIFICATES:

A. Labels of Underwriters' Laboratories, Inc.; Certified Ballasts Manufacturers, and Electrical Testing Laboratories affixed to each item of material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE FIXTURE MANUFACTURERS:

A. Listed in schedule and with materials.

B. Substitutions: If the Contractor proposes to substitute lighting fixtures for those shown on the drawings or specified herein, he shall submit a list of proposed fixtures together with technical data to substantiate that the substitute fixtures are equivalent in all respects to the specified equipment. Proposed substitute fixtures must be submitted to the architect/engineer for review a minimum of ten (10) days prior to the project bid date. Only original documentation will be accepted for review. Copies sent via facsimile or e-mail will not be accepted. After review of the proposed substitute fixtures, an addendum may be issued to include acceptable equipment. The review of substitute equipment in no way relieves the contractor of the responsibility to provide equipment that is equivalent in all respects to specified fixtures. Lighting fixtures as shown on the drawings or specified herein shall be used as a basis and standard of comparison in the review and consideration of fixtures of other manufacturers. The Architect/Engineer shall have the final authority as to whether the fixture is equivalent to the specified item. The proposed substitution may be rejected for the aesthetic value if felt necessary or desirable. In the event the proposed substitutions are rejected, the Contractor shall furnish the specified item

2.2 LED LIGHT FIXTURES:

A. Product Requirements -

1. Each luminaire shall consist of an assembly that utilizes LEDs as the light source. In addition, a complete luminaire shall consist of a housing, LED array, and electronic driver (power supply).
2. Each luminaire shall be rated for a minimum operational life of greater than or equal to 50,000 hours as defined by IES LM-80 and TM-21.
3. Each luminaire shall be designed to operate at an average operating temperature of 25°C.
4. The operating temperature range shall be 10°C to +25°C.
5. Some parameters and tests (such as IESNA standard LM-80-08) shall be conducted at different ambient temperatures.
6. Each luminaire shall meet all parameters of this specification throughout the minimum operational life when operated at the average operating temperature.
7. The individual LEDs shall be connected such that a catastrophic loss or the failure of one LED will not result in the loss of the entire luminaire.

8. Each luminaire shall be listed with a nationally recognized testing laboratory (including but not limited to UL, CSA, ETL) under UL 1598 and UL 8750, or an equivalent standard from a recognized testing laboratory.

B. Technical Requirements –

1. Electrical:

a. Power Efficacy: Minimum power efficacy allowed for the luminaire shall be 85 Lumens per Watt at an input voltage of 277 VAC.
b. Operation Voltage

1) The luminaire shall operate from a 60 HZ ±3 HZ AC line over a voltage ranging from 110 VAC to 277 VAC. The fluctuations of line voltage shall have no visible effect on the luminous output.
2) The standard operating voltages are 120 VAC, 277 VAC.

c. Power Factor: The luminaire shall have a power factor of 0.90 or greater at all standard operating voltages
d. THD: Total harmonic distortion (current and voltage) induced into an AC power line by a luminaire shall not exceed 20 percent at any standard input voltage.
e. Surge Suppression: The luminaire shall include surge protection to withstand high repetition noise and other interference.

1) The surge protection which may reside within the driver shall protect the luminaire from damage and failure for transient voltages and currents as defined in ANSI/IEEE C64.41 1991 for Location Category A Low. Where failure does not mean a momentary loss of light during the transient event.

f. Operational Performance: The LED circuitry shall prevent perceptible flicker to the unaided eye over the voltage range specified above.
g. RF Interference: The luminaire and associated onboard circuitry must meet Class A emission limits referred in Federal Communications Commission (FCC) Title 47, Subpart B, Section 15 regulations concerning the emission of electronic noise.
h. Dimming: The luminaire shall be capable of continuous dimming without perceivable flicker over a range of 100% to 5% of rated lumen output, unless scheduled otherwise. Dimming shall be controlled by a 0-10V signal.

C. Photometric Requirements -

1. Light Output

a. The manufacture shall publish initial lumen output of the luminaire in the 0-90 degree zone - as measured by IESNA Standard LM-79-08.
b. Projected L70 life shall be at least 50,000 hrs based on IESNA TM-21 calculations performed using IESNA LM-80 test data.
c. The measurements shall be calibrated to standard photopic calibrations.

2. Light Color/Quality.

a. Corrected Color temperature (CCT) range between 3,500K and 4,100K shall be correlated to chromaticity as defined by the absolute (X,Y) coordinates on the 2-D CIE chromaticity chart.
b. The color rendition index (CRI) shall be 80 or greater.

D. Thermal Management -

1. The thermal management (of the heat generated by the LEDs) shall be of sufficient capacity to assure proper operation of the luminaire over the rated minimum operational life.

a. The LED manufacturer's maximum junction temperature for the rated minimum operational life shall not be exceeded at the average operating ambient.
b. The LED manufacturer's maximum junction temperature for the catastrophic failure shall not be exceeded at the maximum operating ambient.
c. The luminaire shall have an UL IC rating, if recessed into an insulated ceiling.

2. The Driver manufacturer's maximum case temperature shall not be exceeded at the maximum operating ambient. Thermal management shall be passive by design.

a. The use of fans or other mechanical devices shall not be allowed.

E. Physical and Mechanical Requirements -

1. The luminaire shall be a single, self-contained device, not requiring onsite assembly for installation. The power supply for the luminaire shall be integral to the unit.
2. The assembly and manufacturing process for the luminaire shall be designed to assure all internal components are adequately supported to withstand mechanical shock and vibration.
3. The optical assembly of the luminaire shall assure individual LED image are not visible to the occupant.
4. The electronics/power supply enclosure shall be internal to the luminaire and be accessible per UL requirements
5. The circuit board and power supply shall be contained inside the luminaire.
6. Electrical connections between normal power, driver and LED boards must be modular. All electrical components must be easily accessible after installation from the room side and all electrical components must to be able to be replaced without removing the fixture from the ceiling.
7. Housings shall be fabricated from post or pre-painted aluminum or cold rolled steel.

a. Each refractor or lens shall be made from UV inhibited high impact plastic (such as acrylic or polycarbonate) or heat and impact resistant glass,
b. Polymeric materials (if used) of enclosures containing either the power supply or electronic components of the luminaire shall be made of UL94VO flame retardant materials. The lenses (lens) of the luminaire are excluded from this requirement.

F. Acceptable Manufacturers – Lithonia, Williams, Cooper, Visa, as scheduled, or approved equivalent.

2.3 ACCESSORIES:

A. Manufacturers' standard mounting ring, trim flanges, hanger bars, spacers, supports, plaster frames of non- ferrous material or cadmium plated steel. Do not use painted steel plaster frames.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect Architectural drawings and specifications.

B. Inspect Architectural reflected ceiling plans.

C. Inspect installed ceiling components and construction for defects affecting the quality and execution of work.

3.2 PREPARATION:

A. Utilize Architectural drawings and specifications to determine ceiling material to be installed.

B. Verify ceiling material and alignment.

C. Layout exact locations of fixtures in accordance with reflected ceiling plans, fixtures' and switches' outlet boxes and supports.

D. Provide outlet boxes and conduit.

E. Provide fixture trim and hardware appropriate for architecturally selected ceiling materials.

F. Provide appropriate hardware to support outlet boxes from structure. Support light fixtures directly from building structure in accordance with Uniform Building Code Standard 25- 2.

3.3 INSTALLATION:

A. Provide lighting fixtures, lamps, switches, and control systems, and wiring.

B. If designation omitted on drawings, provide same type fixtures employed in rooms of similar usage.

C. Provide spacers for fixtures mounted on low density ceiling material.

D. Provide plaster frames for recessed fixtures in plaster ceilings.

E. Install fixtures in and on acoustical tile ceilings in alignment with tile joints.

F. Install fixtures in fiber decking and form board so outlet boxes and openings will not be sight exposed.

G. Prepare fixtures and trim required to be painted. Refer to other Section.

H. Note: Outlet boxes locations on drawings are diagrammatic only. Position outlet boxes to coincide with suspension hangers and knockouts.

I. Install in accordance with manufacturer's instructions, submittal data, and details on the drawings.

3.4 ADJUSTMENT AND CLEANING:

A. Adjustment: Adjust lamp positions for desired effects. Align fixtures with building walls and tile joints.

B. Cleaning: Remove dirt, grease, and foreign materials from interior and exposed surfaces of all fixtures.

3.5 LIGHTING FIXTURE SCHEDULE: Refer to drawings for fixture schedule.

END OF SECTION 26 50 00