PROJECT MANUAL

Texas A&M Corpus Christi – Islander Dining Hall Renovation

Corpus Christi, TX

April 10, 2024 | Issue for Construction

OMNIPLAN

DOCUMENT 00 01 01

PROJECT DIRECTORY

OWNER:	**Texas A&M Corpus Christi** 6300 Ocean Drive Corpus Christi, TX 78412 361.825.2107 Contact: Scott Meares scott.meares@tamucc.edu
ARCHITECT:	**OMNIPLAN INC.** 1845 Woodall Rodgers Freeway, Suite 1600 Dallas, TX 75201 214.775.0671 Contact: Kristin Kolowich John kjohn@omniplan.com
MEP ENGINEER:	**Baird, Hampton & Brown** 6300 Ridglea Place, Suite 700 Fort Worth, TX 76116 817.338.1277 Contact: Allen Grammer, PE tgrammer@bhbinc.com Contact: Thomas Wilson, PE twilson@bhbinc.com
STRUCTURAL ENGINEER:	**Baird, Hampton & Brown** 6300 Ridglea Place, Suite 700 Fort Worth, TX 76116 817.338.1277 Contact: Ronald Ishmael, PE rishmael@bhbinc.com

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PROFESSIONAL SEALS PAGES

The following specifications sections have been provided by the Architect:

ARCHITECT: **OMNIPLAN, INC.**
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Dallas, Texas 75201
214.775.0671
Contact: Kristin Kolowich John
Email: kjohn@omniplan.com

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The following specifications sections have been provided by the Engineer:

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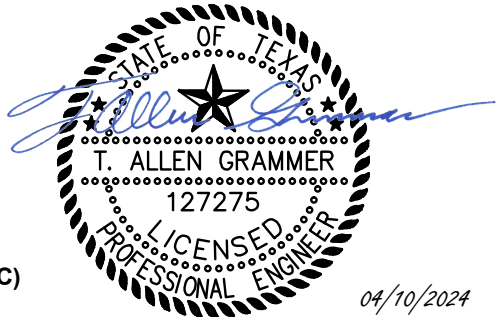

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1.1 To be issued separately by Owner.

END OF SECTION

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SUPPLEMENTARY CONDITIONS

1.1 SUPPLEMENTS

A. To be issued separately by Owner.

END OF DOCUMENT

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. Definitions.
2. Project information.
3. Work covered by Contract Documents.
4. Work by Owner.
5. Owner-furnished products.
6. Access to site.
7. Specification and drawing conventions.
8. Project work restrictions

1.3 DEFINITIONS

A. The “Contract Documents” are defined in the General Conditions of the Contract for Construction.

B. All definitions included in the Agreement or the other Contract Documents shall apply to the Specifications.

C. The “Addenda” consist of written or graphic instruments issued by Owner or the Architect prior to the execution of the Agreement which modify or interpret the Contract Documents by additions, deletions, clarifications and corrections.

D. The “Architect” is the registered Architect under contract with Owner.

E. An “Alternate” is an amount to be added to or deducted from the amount of the Subcontract Sum if the corresponding change in the scope of the Work or products or methods of execution of the Work described in the Bidding Documents are accepted by Owner.

F. “Day” means calendar day unless specifically identified otherwise.

G. “Substantial Completion” of the Project or designated portion thereof shall be the date determined by Owner when the Project is sufficiently complete so the Owner and its Agents (Tenants) can occupy or utilize the Project or designated portion thereof for the use indicated by the Contract Documents.

H. A “Unit Price” is an amount stated as a price per unit of measurement for products or services described in the Contract Documents. Unit prices may be used to increase or decrease the Subcontract Sum in accordance with the “changes” clause of the Agreement.

I. “Work” is defined in the General Conditions of the Contract for Construction.

1.4 PROJECT INFORMATION

A. Project Identification: Islander Dining Hall at Texas A&M Corpus Christi

B. Project Location: 6300 Ocean Drive, Corpus Christi, TX 78412

C. Owner: Texas A&M Corpus Christi

1. Owner's Representative: Scott Meares

D. Architect: Omniplan, Inc., 1845 Woodall Rodgers Fwy., Suite 1600, Dallas, TX 75201.

E. Owner's Consultants: None.

F. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:

1. Refer to Title Page.

G. Original Electronic Drawings Format: Revit

1.5 WORK COVERED BY CONTRACT DOCUMENTS

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

1. Interior renovation of existing dining hall on an existing 1-story building. No changes to parking requirements, parking is provided in university parking lots close to the building.

The scope consists of new finishes, new furniture, new millwork, new lighting, new kitchen equipment as noted, new exhaust hood, roof penetrations, and upgrades to electrical and mechanical as required for new equipment added.

A. Type of Contract:

1. Project will be constructed under a single prime contract.

1.2 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.

3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.3 GENERAL REQUIREMENTS APPLICABLE TO ALL CONTRACTORS:

A. Section 01 00 00 Summary of Work

B. Section 01 23 00 Alternates

C. Section 01 25 00 Substitution Procedures

D. Section 01 25 01 Substitution Request Form

E. Section 01 26 00 Contract Modification Procedures

F. Section 01 31 00 Project Management and Coordination

G. Section 01 32 00 Construction Progress Documentation

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S. Section 01 77 00 Closeout Procedures

T. Section 01 78 23 Operation and Maintenance Data

U. Section 01 78 39 Project Record Documents

V. Section 01 79 00 Demonstration and Training

1.4 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

1.5 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products.

B. Owner-Furnished Products:

1. Point of Sales Equipment.

2. Food Service Equipment.

1.6 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

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. Obtain copy of work requirements and restrictions imposed by City, County or other Authorities Having Jurisdiction for the project, from Owner, and comply with requirements and restrictions indicated.

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. Non-smoking Project Site: Smoking is not permitted within the project site boundary or within 50 feet of project site entrances.

C. Controlled Substances: Use of alcohol, illegal substances, tobacco products or other controlled substances on Project site is not permitted.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONTRACTOR RESPONSIBILITIES

A. Except as specifically noted, provide and pay for all:

1. Labor, materials and equipment.
2. Tools, construction equipment and machinery.
3. Water, heat and utilities required for construction.
4. Direct jobsite costs and home office overhead.
5. Insurance and taxes.
6. Other facilities and services necessary for proper execution and completion of the Work.

B. Comply with all laws, codes, ordinances, rules, regulations, orders and other legal requirements of public entities having authority over the Project or the performance of the Work.

C. Secure and pay for the following items, as necessary, for proper execution and completion of the Work, and as applicable at the time of receipt of Bids:

1. Fees.
2. Licenses.
3. Bonds.
4. Temporary utilities until Substantial Completion of project.

D. Give required notices.

E. Provide for all surveying and layout for the execution of the Work from the Project control points established by Owner and its consultants.

F. Verify all grades, including ADA related grades for all flatwork, sidewalk or parking lot areas (including accessible parking spaces as required by applicable Codes or authorities having jurisdiction) lines, levels and dimensions indicated on the Drawings and report any inconsistencies to Owner before commencing the Work.

3.2 CONTRACTOR'S USE OF PREMISES

A. Restriction to the Work.

1. Existing facilities, streets, and utilities adjacent to the Project will continue in normal operation during the execution of the Agreement. Contractor will plan and execute the Work without interfering with the Utility Owner’s existing operations or concurrent projects.
2. Contractor shall conduct the Work with a minimum disturbance or interference and in such a manner as to not restrict or obstruct entrances, exits, passageways, utility services or material delivery and pick-up. Contractor shall move material and equipment into the Work area through entrances approved by Owner.
3. None of the foregoing terms will be construed as a restriction on prosecution of Contractor’s Work.

B. Contractor shall confine operations at the Project site to areas permitted by:

1. Law.
2. Ordinances.
3. Permits.
4. Contract Documents.
5. Owner.

C. Contractor shall not unreasonably encumber the Project site with materials or equipment.

D. Contractor shall locate equipment and materials throughout the Project so as to not impose excessive loads to supporting walls, floors or structures.

E. Contractor shall assume full responsibility for protection and safekeeping of materials and equipment stored on the Project site.

F. Contractor shall obtain and pay for use of additional storage or areas needed for operation.

G. Contractor shall park vehicles in areas designated by Owner.

1. No parking will be permitted on adjacent streets, fire lanes or access roads.
2. It shall be the responsibility of the Contractor to provide parking for its laborers, employees, suppliers and subcontractors in the event adequate parking space (as determined by Owner) is not available on the Project site.
3. Parking and staging areas shall relocate from time to time as determined by Owner. Contractor shall comply with Owner's request without additional cost.

END OF SECTION

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 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 alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify 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. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

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

D. 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. A list of required Alternates to be issued separately by Owner.

END OF SECTION

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.

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. Substitution Request Form: Use facsimile of form provided in Project Manual.

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 or other agency approved by local authority.

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 15 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. Requested substitution provides sustainable design characteristics that specified product provided per Section 01 81 14.

c. Substitution request is fully documented and properly submitted.

d. Requested substitution will not adversely affect Contractor's construction schedule.

e. Requested substitution has received necessary approvals of authorities having jurisdiction.

f. Requested substitution is compatible with other portions of the Work.

g. Requested substitution has been coordinated with other portions of the Work.

h. Requested substitution provides specified warranty.

i. 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: Architect will consider requests for substitution if received within 60days after commencement of the Work. Requests received after that time may be considered or rejected at discretion of Architect.

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 offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for

redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

b. Requested substitution does not require extensive revisions to the Contract Documents.

c. Requested substitution is consistent with the Contract Documents and will produce indicated results.

d. Requested substitution provides sustainable design characteristics that specified product provided per Section 01 81 14.

e. Substitution request is fully documented and properly submitted.

f. Requested substitution will not adversely affect Contractor's construction schedule.

g. Requested substitution has received necessary approvals of authorities having jurisdiction.

h. Requested substitution is compatible with other portions of the Work.

i. Requested substitution has been coordinated with other portions of the Work.

j. Requested substitution provides specified warranty.

k. 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 25 01

SUBSTITUTION REQUEST FORM

1.1 PROJECT:_____ **(After Contract Award)**

1.2 TO: _____

1.3 DATE: _____

1.4 Contractor hereby requests acceptance of the following product or system as a substitution in accordance with provisions of Division 01 Section "Substitution Procedures:"

1.5 SPECIFIED PRODUCT OR SYSTEM

A. Substitution request for: _____

B. Specification Section No.:_____ Article/ Paragraph: _____

1.6 REASON FOR SUBSTITUTION REQUEST

	SPECIFIED PRODUCT . . .	PROPOSED PRODUCT …
B.	□ Is no longer available.	□ Will reduce construction time
C.	□ Is unable to meet project schedule.	□ Will result in cost savings of
D.	□ Is unsuitable for the designated application.	$_____ to Project
E.	□ Cannot interface with adjacent materials.	□ Is for supplier's convenience
F.	Is not compatible with adjacent materials.	□ Is for subcontractor's convenience
G.	□ Cannot provide the specified warranty.	□ Other:_____
H.	□ Cannot be constructed as indicated _____	
I.	□ Cannot be obtained due to one or more of the following:	
1.	□ Strike	□ Bankruptcy of manufacturer or supplier
2.	□ Lockout	□ Similar occurrence (explain below)

1.7 SUPPORTING DATA

A. □ Drawings, specifications, product data, performance data, test data, and any other necessary information to facilitate review of the Substitution Request are attached.

B. □ Sample is attached. □ Sample will be sent if requested.

1.8 QUALITY COMPARISON

A. Provide all necessary side-by-side comparative data as required to facilitate review of Substitution Request:

	a. SPECIFIED PRODUCT	PROPOSED PRODUCT
B. Manufacturer:	_____	_____
C. Name / Brand:	_____	_____
D. Catalog No.:	_____	_____
E. Vendor:	_____	_____
F. Variations:	_____	_____

1) (Add Additional Sheets If Necessary)

G. Local Distributor or Supplier: _____

H. Maintenance Service Available: □ Yes □ No

I. Spare Parts Source: _____

J. Warranty: □ Yes □ No _____Years

1.9 PREVIOUS INSTALLATIONS

A. Identification of at least three similar projects on which proposed substitution was used:

B. PROJECT #1:

C. Project: _____

D. Address: _____

E. Architect: _____

F. Owner: _____

G. Contractor: _____

H. Date Installed: _____

I. PROJECT #2:
J. Project: _____
K. Address: _____

L. Architect: _____
M. Owner: _____
N. Contractor: _____
O. Date Installed: _____
P. PROJECT #3:
Q. Project: _____
R. Address: _____
S. Architect: _____
T. Owner: _____
U. Contractor: _____
V. Date Installed: _____

1.10 EFFECT OF SUBSTITUTION

A. Proposed substitution affects other work or trades: □ No □ Yes (if Yes, explain)

_____

_____

B. Proposed substitution requires dimensional revisions or redesign of architectural, structural, M-E-P, life safety, or other work:
1. □ No □ Yes (if Yes, attach data explaining revisions)

1.11 STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS

A. Contractor and Subcontractor have investigated the proposed substitution and hereby represent that:
B. They have personally investigated the proposed substitution and believe that it is equal to or superior in all respects to specified product, except as stated above;
C. The proposed substitution is in compliance with applicable codes and ordinances;
D. The proposed substitution will provide same warranty as specified for specified product;
E. They will coordinate the incorporation of the proposed substitution into the Work, and will include modifications to the Work as required to fully integrate the substitution;
F. They have included complete cost data and implications of the substitution (attached);
G. They will pay any redesign fees incurred by the Architect or any of the Architect's consultants, and any special inspection costs incurred by the Owner, caused by the use of this product;
H. They waive all future claims for added cost or time to the Contract related to the substitution, or that become known after substitution is accepted.
I. The Architect's approval, if granted, will be based upon reliance upon data submitted and the opinion, knowledge, information, and belief of the Architect at the time decision is rendered and Addendum is issued; and that Architect's approval therefore is interim in nature and subject to reevaluation and reconsideration as additional data, materials, workmanship, and coordination with other work are observed and reviewed.
J. Contractor:_____

(Name of Contractor)

K. Date:_____ By: _____

L. Subcontractor:_____

(Name of Subcontractor)

M. Date:_____ By: _____

N. NOTE: UNRESPONSIVE OR INCOMPLETE REQUESTS WILL BE REJECTED AND RETURNED WITHOUT REVIEW.

1.12 ARCHITECT'S REVIEW AND ACTION

A. □ Substitution is accepted.

B. □ Substitution is accepted, with the following comments:_____

1. _____
2. _____

C. Resubmit Substitution Request:

a) □ Provide more information in the following areas:
_____

b) _____

c) _____

d) □ Provide proposal indicating amount of savings / credit to Owner

e) □ Bidding Contractor shall sign Bidder's Statement of Conformance

f) □ Bidding Subcontractor shall sign Bidder's Statement of Conformance

D. □ Substitution is not accepted:

a) □ Substitution Request received too late.

b) □ Substitution Request received directly from subcontractor or supplier.

c) □ Substitution Request not submitted in accordance with requirements.

d) □ Substitution Request Form is not properly executed.

e) □ Substitution Request does not indicate what item is being proposed.

f) □ Insufficient information submitted to facilitate proper evaluation.

g) □ Proposed product does not appear to comply with specified requirements.

h) □ Proposed product will require substantial revisions to Contract Documents.

E. By: _____

F. Date:_____

1.13 Architect has relied upon the information provided by the Contractor, and makes no claim as to the accuracy, completeness, or validity of such information. If an accepted substitution is later found to be not in compliance with the Contract Documents, Contractor shall provide the specified product.

1.14 OWNER'S REVIEW AND ACTION

A. □ Substitution is accepted; Architect to prepare Change Order.

B. □ Substitution is not accepted.

C. □ Owner will pay Architect directly for redesign fees.

D. □ Include Architect's Additional Service fee for implementing the substitution in the Change Order.

1.15 By: _____
(Owner/Owner's Representative)

1.16 Printed Name: _____

1.17 Date: _____

END OF FORM

SECTION 01 26 00

CONTRACT MODIFICATION 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 handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
      e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or other forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
   7. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or other form acceptable to Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 01 21 00 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Section 01 22 00 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 or other form acceptable to Architect.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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 Interpretation (RFIs).
4. Project Web site.
5. Project meetings.

1.3 DEFINITIONS

A. RFI: Request for Interpretation: A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

1.4 INFORMATIONAL SUBMITTALS

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

1. Name, address, and telephone number of entities 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. Key Personnel Names: Within 15 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, on Project Web site, 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.

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. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.

c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.

d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.

e. Indicate required installation sequences.

f. 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.

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.

2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.

3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.

4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

5. 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.

6. Mechanical and Plumbing Work: Show the following:

   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.

   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.

   c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.

   b. Light fixture, exit light, 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 centerlines.

8. Fire-Protection System: Show the following:

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

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. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

   a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.

   b. Digital Data Software Program: Refer to Section 0110 00 "Summary" for digital data software program.

   c. Contractor shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. Whenever possible, request clarifications at the next appropriate project progress meeting, with response

entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

B. Preparation: Prepare and submit an RFI in the form specified, immediately on discovery of the need for interpretation of the Contract Documents. Failure to submit an RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.

1. Prepare a separate RFI for each specific item.

a. Review, coordinate, and comment on requests originating from subcontractor and/or material suppliers.

b. Do not forward requests which solely require internal coordination between subcontractors.

2. Coordinate and submit RFIs in a prompt manner in order to avoid delays in Contractor's work or work of subcontractors

3. Architect will return RFIs submitted to Architect by entities other than the Contractor with no response.

C. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.

1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.

2. Unacceptable Uses for RFIs: Do not use RFIs to request the following:

a. Approval of submittals (use procedures specified elsewhere in this section).

b. Approval of substitutions (see Section - 01 60 00 - Product Requirements)

c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).

d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).

3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.

4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

D. 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.

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.

E. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

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

F. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect 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 in writing within 10 days of receipt of the RFI response.

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

1. Project name.

2. Name and address of Contractor.

3. Name and address of Architect.

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.

H. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven 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 PROJECT MEETINGS

A. General: 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 and Architect, within three days of the meeting.

B. Pre-construction Conference: Schedule and conduct a pre-construction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.

2. Attendees: Authorized representatives of Owner 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.

3. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.

b. Critical work sequencing and long-lead items.

c. Designation of key personnel and their duties.

d. Lines of communications.

e. Procedures for processing field decisions and Change Orders.

f. Procedures for RFIs.

g. Procedures for testing and inspecting.

h. Procedures for processing Applications for Payment.

i. Distribution of the Contract Documents.

j. Submittal procedures.

k. Sustainable design requirements.

l. Preparation of record documents.

m. Use of the premises.

n. Work restrictions.

o. Responsibility for temporary facilities and controls.

p. Procedures for moisture and mold control.

q. Procedures for disruptions and shutdowns.

r. Construction waste management and recycling.

s. Parking availability.

t. Office, work, and storage areas.

u. Equipment deliveries and priorities.

v. First aid.

w. Security.

x. Progress cleaning.

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

C. Pre-installation Conferences: Conduct a pre-installation 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 Owner's Commissioning Authority 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. Sustainable design requirements.

i. Review of mockups.

j. Possible conflicts.

k. Compatibility requirements.

l. Time schedules.

m. Weather limitations.

n. Manufacturer's written instructions.

o. Warranty requirements.

p. Compatibility of materials.

q. Acceptability of substrates.

r. Temporary facilities and controls.

s. Space and access limitations.

t. Regulations of authorities having jurisdiction.

u. Testing and inspecting requirements.

v. Installation procedures.

w. Coordination with other work.

x. Required performance results.

y. Protection of adjacent work.

z. 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: 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, Owner's Commissioning Authority, 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 completing sustainable design documentation.

e. Requirements for preparing operations and maintenance data.

f. Requirements for delivery of material samples, attic stock, and spare parts.

g. Requirements for demonstration and training.

h. Preparation of Contractor's punch list.

i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.

j. Submittal procedures.

k. Owner's partial occupancy requirements.

l. Installation of Owner's furniture, fixtures, and equipment.

m. Responsibility for removing temporary facilities and controls.

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

E. Progress Meetings: Conduct progress meetings at bi-weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.

2. Attendees: In addition to representatives of Owner 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) Status of sustainable design documentation.

5) Deliveries.

6) Off-site fabrication.

7) Access.

8) Site utilization.

9) Temporary facilities and controls.

10) Progress cleaning.

11) Quality and work standards.

12) Status of correction of deficient items.

13) Field observations.

14) Status of RFIs.

15) Status of proposal requests.

16) Pending changes.

17) Status of Change Orders.

18) Pending claims and disputes.

19) 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: Conduct Project coordination meetings at biweekly 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 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. Review present and future needs of each contractor 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) Work hours.

10) Hazards and risks.

11) Progress cleaning.

12) Quality and work standards.

13) Change Orders.

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

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. Startup 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.

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. 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.

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

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

E. 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.

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. Startup construction schedule.

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

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

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

E. Daily Construction Reports: Submit at weekly intervals.

F. Material Location Reports: Submit at monthly intervals.

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

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

I. 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. Review delivery dates for Owner-furnished products.
4. Review schedule for work of Owner's separate contracts.
5. Review submittal requirements and procedures.
6. Review time required for review of submittals and resubmittals.
7. Review requirements for tests and inspections by independent testing and inspecting agencies.
8. Review time required for Project closeout and Owner startup procedures.
9. Review and finalize list of construction activities to be included in schedule.
10. 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 commencement of the Work to date of final 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.

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 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. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.

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. Seasonal variations.

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. Building flush-out.

m. 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.

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.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

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

B. Startup Network Diagram: Submit diagram within 14 days of date established for commencement of the Work. 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 commencement of the Work.

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

startup 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.
    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. Immediately 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.

2.3 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 or snow.
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.

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) 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 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

SECTION 01 32 33
PHOTOGRAPHIC 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 the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Periodic construction photographs utilizing drone vantage locations.
4. Final completion construction photographs.

1.3 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph and video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:
    a. Name of Project.
    b. Name and contact information for photographer.
    c. Name of Architect.
    d. Name of Contractor.
    e. Date photograph was taken.
    f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
    g. Unique sequential identifier keyed to accompanying key plan.

C. Video Recordings: Submit video recordings within three days of recording.

1. Submit video recordings in digital video disc format acceptable to Owner.
2. Identification: With each submittal, provide the following information:
    a. Name of Project.
    b. Name and contact information of photographer.

c. Name of Architect.

d. Name of Contractor.

e. Date video recording was recorded.

f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

g. Weather conditions at time of recording.

h. Unique sequential identifier keyed to accompanying key plan.

1.4 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

B. Digital Video Recordings: Provide high-resolution, digital video disc in format acceptable to Owner.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in file name for each image.

2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

C. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag construction limits before taking construction photographs.

2. Provide 20 photographs minimum to show existing conditions adjacent to property before starting the Work.

3. Provide 20 photographs minimum of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.

4. Provide additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

D. Periodic Construction Photographs: Take 20 photographs minimum monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken. Provide photos or video footage taken utilizing drone aeronautical device in addition to the photographs required to accompany the Application for Payment. Confirm vantage points of drone recordings with Owner.

E. Final Completion Construction Photographs: Take 20 color photographs minimum after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.

1. Do not include date stamp.

END OF SECTION

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.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect'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 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 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 startup construction schedule. 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. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

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 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. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.

b. Digital Drawing Software Program: The Contract Drawings are available in software program noted in Section 01 10 00 “Summary."

c. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.

d. The following digital data files will by furnished for each appropriate discipline:

1) Floor plans.

2) Reflected ceiling plans.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section 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 reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence upon 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. Submittals received by Architect after 1:00pm (CST) will be considered as received the following working day.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination. Allow for an extended review period of up to 21 days for large or complex submittals requiring additional review time. Examples of submittals which may require additional review time include, but not limited to: Waterproofing Systems, Curtain Wall Systems, Concrete Forming and Reinforcement, Structural Steel, Millwork, Doors, Frames, Hardware.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.

3. Resubmittal Review: Allow 15 days for review of each resubmittal.

4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Electronic Submittals: 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 an identifier consisting of the Specification Section number followed by a decimal point and then a sequential number of the Article number, dash, submittal number / letter, dash, sequence number, dash, revision number (e.g., 05 52 13-1.3C-02-R0). Resubmittals shall include a numeric indication (e.g., 05 52 13-1.3C-02-R1).

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 of Contractor.

   e. Name of firm or entity that prepared submittal.

   f. Names of subcontractor, manufacturer, and supplier.

   g. Category and type of submittal.

   h. Specification Section number and title.

   i. Specification paragraph number or drawing designation and generic name for each of multiple items.

   j. Drawing number and detail references, as appropriate.

   k. Location(s) where product is to be installed, as appropriate.

   l. Related physical samples submitted directly.

   m. Indication of full or partial submittal.

   n. Transmittal number numbered consecutively.

   o. Submittal and transmittal distribution record.

   p. Other necessary identification.

   q. 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 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 and number of copies as initial submittal.

1. Note date and content of previous submittal. Include all submittal information from previous submittal in resubmittal to create a complete submittal document for review.

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 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 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. Post electronic submittals as PDF electronic files directly to Architect's Info Exchange Folder (Newforma) specifically established for Project.

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

2. Submit electronic submittals via email as PDF electronic files.

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

3. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.

4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.

5. 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.

b. Provide a notarized signature on the original paper document of certificates and certifications where indicated.

B. 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.

3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.

b. Manufacturer's product specifications.

c. Standard color charts.

d. Statement of compliance with specified referenced standards.

e. Testing by recognized testing agency.

f. Application of testing agency labels and seals.

g. Notation of coordination requirements.

h. 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. 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.

C. 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, unless submittal based on Architect's digital data drawing files is otherwise permitted.

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

a. Identification of products.

b. Dimensions.

c. Rough-in and setting diagrams.

d. Fabrication and installation drawings.

e. Schedules.

f. Templates and patterns.

g. Shopwork manufacturing instructions.

h. Wiring diagrams indicating field-installed wiring, including power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

i. Compliance with specified standards.

j. Notation of coordination requirements.

k. Notation of dimensions established by field measurement.

l. Relationship and attachment to adjoining construction clearly indicated.

m. Design Calculations, where specified in individual Section requirements.

n. Seal and signature of professional engineer, where specified in individual Section requirements.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.

3. Submit Shop Drawings in the following format:

a. PDF electronic file.

4. BIM File Incorporation: Develop and incorporate Shop Drawing Files into Building Information Model established for the Project.

a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

b. Refer to Section 01 31 00 – Project Management and Coordination, for requirements for coordination drawings.

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

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach 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 and generic name of each item.

3. 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.

4. 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.

5. 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(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. 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 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.

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

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

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures."

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

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

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

L. 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.

M. 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.

N. 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.

O. 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.

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

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

R. 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.

S. 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.

T. 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.

U. 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.

V. 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.

W. 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.

X. 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.

2.2 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 file paper copies of certificate, 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.

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.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

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

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

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

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

END OF SECTION

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, 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.

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.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.

D. Pre-construction 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.

E. 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.

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

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

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

I. 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).

J. 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.

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.

1.6 INFORMATIONAL SUBMITTALS

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

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

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article 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.

E. 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.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of commencement of construction, 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 and submit 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 re-inspecting.

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 representatives 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 of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. 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.

I. 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.

J. 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. 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, 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.

K. Mock-ups: Before installing portions of the Work requiring mock-ups, build mock-ups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mock-ups in location and of size indicated or, if not indicated, as directed by Architect.

2. Notify Architect seven days in advance of dates and times when mockups will be constructed.

3. Employ supervisory personnel who will oversee mock-up construction. Employ workers that will be employed during the construction at Project.

4. Demonstrate the proposed range of aesthetic effects and workmanship.

5. Assemble and erect specified items and systems with specified attachment and anchorage devices, flashings, seals and finishes.

6. Testing:

   a. Where testing of mock-up is required by specific Section, coordinate requirements with Testing Agency and construct in accordance with testing agency requirements to facilitate testing procedures.

   b. Tests shall be performed under provisions identified in this Section and identified in the respective product specification sections.

7. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

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

   b. Architect will issue written comments of initial review and each subsequent follow-up review of each mockup.

   c. Make corrections as necessary until Architect’s acceptance is issued.

8. Accepted mockups establish the standard of quality and shall be utilized as a comparison standard for the remaining Work.

9. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

10. Removal of Mock-Ups: Where mock-up has been accepted by Architect and no longer needed, demolish and remove mock-up and clear area when directed to do so.

L. Integrated Exterior Mock-ups: Construct integrated exterior mock-up according to approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mock-ups are required in individual Specification Sections, along with supporting materials.

M. Room Mock-ups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable

Architect to evaluate quality of the Work. Provide room mock-ups of the following rooms:

1. To be determined.

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 inspecting they are engaged to perform.

2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

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. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these 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. Manufacturer's Field Services:

1. Where indicated, engage a manufacturer-authorized service representative to observe and inspect the Work, site conditions, conditions of the surfaces and installation, quality of workmanship, field-assembled components and equipment installation, including service connections, equipment start-up, test, adjust and balance of equipment and final completion as applicable, and to initiate instructions when necessary.

2. 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.

3. Report observations, site decisions or instructions given to applicators or installers which are supplemental to or contrary to manufacturer’s written instructions.

4. Report results in writing as specified in Section 01 33 00 "Submittal Procedures" as an Informational Submittal.

D. Retesting/Re-inspecting:

1. Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

2. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

E. Testing and Inspection:

1. Testing Agency Responsibilities:

a. Cooperate with Architect and Contractor in performance of duties.

b. Refer to Drawings and individual specification Sections for required testing.

c. Provide qualified personnel to perform required tests and inspections.

d. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

e. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

f. Conduct and interpret tests and inspections in accordance with specified standards and state in each report whether tested and inspected work complies with or deviates from requirements.

g. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor. Provide copies to Owner and Architect. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

h. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.

i. Do not perform any duties of Contractor.

2. Contractor Responsibilities:

a. Cooperate with agencies 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:

b. Access to the Work.

c. Incidental labor and facilities necessary to facilitate tests and inspections.

d. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.

e. Facilities for storage and field curing of test samples.

f. Delivery of samples to testing agencies.

g. Preliminary design mix proposed for use for material mixes that require control by testing agency.

h. Security and protection for samples and for testing and inspecting equipment at Project site.

i. 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.

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

k. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

l. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.

2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.

3. 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.

4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and re-inspecting 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. Replace Work or portions of the Work not conforming to specified requirements.

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

END OF SECTION

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY OF REFERENCE STANDARDS

A. Regulatory requirements applicable to this project include, but are not limited to, the following:

B. ICC (IFC) - International Fire Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ICC (IPC) - International Plumbing Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. ICC (IMC) - International Mechanical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. ICC (IECC) - International Energy Conservation Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. ICC (IPMC) - International Property Maintenance Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. Erosion and Sedimentation Control Regulations: SWPPP: “Stormwater Pollution Prevention Plan." SWPPP is sometimes referred to as SWP3 or SWP2 or SWPP, depending on the jurisdiction https://www.tceq.texas.gov/permitting/stormwater . Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010. https://www.ada.gov/index.html

K. TAS Standards - Texas Accessibility Standards (TAS): 2012 TAS -Texas Accessibility Standards. Elimination of Architectural Barriers, Texas Government Code, Chapter 469, Administered by the Texas Department of Licensing and Regulation. https://www.tdlr.texas.gov/ab/abtas.htm

L. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

M. 29 CFR 1910 - Occupational Safety and Health Standards current edition. https://www.ecfr.gov/cgi-bin/ECFR?page=browse

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements.

1.03 QUALITY ASSURANCE

A. Contractor's Designer Qualifications: Refer to Section - 01 40 00 - Quality Requirements.

PART 2 PRODUCTS - NOT USEDS

PART 3 EXECUTION - NOT USED

END OF SECTION

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 SUMMARY

A. This Section supplements the definitions contained in the General Conditions.

B. General: Basic Contract definitions are included in the Conditions of the Contract.

C. Other definitions are included in individual Specification Sections.

1.3 DEFINITIONS

A. 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.

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

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

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

F. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

G. Project Manual: The book-sized volume which includes the procurement requirements (if any), contracting requirements, and the specifications.

H. 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.

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

J. 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.

K. Supply: Same as Furnish.

1.4 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.

1.5 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."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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.

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, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

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.

3. 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.

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. Identify further options if proposed measures are later determined to be inadequate. 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 Texas Accessibility Standards and the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines.

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, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch- OD top rails.

B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

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. Common-Use Field Office: Temporary office hosted inside the building is acceptable. Keep office area clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.

2. Drinking water.

3. Coffee machine and supplies.

4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.

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.

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. Sanitary Facilities: Provide 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.

B. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.

b. Provide one telephone line(s) for Owner's use.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.

b. Ambulance service.

c. Contractor's home office.

d. Contractor's emergency after-hours telephone number.

e. Architect's office.

f. Engineers' offices.

g. Owner's office.

h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

C. Electronic Communication Service: Provide a desktop computer in the primary field to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:

1. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions with wireless connection.

2. Internet Service: Wireless, broadband modem, router and ISP, equipped with hardware firewall, providing minimum 384 Kbps upload and 1 Mbps download speeds at each computer.

3.3 SUPPORT FACILITIES INSTALLATION

A. 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.

B. Parking: Provide temporary parking areas for construction personnel.

C. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.

2. Remove snow and ice as required to minimize accumulations.

D. 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 always legible.

E. 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.

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 erosion- and sedimentation-control Drawings.

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 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 environmentally safe materials.

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 required to enclose entire Project site or portion determined enough to accommodate construction operations.

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 workday.

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. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.

1. Construct covered walkways using scaffold or shoring framing.
2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Paint and maintain appearance of walkway for duration of the Work.

L. 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.

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

N. 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: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

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 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 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. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

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. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

2. 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

SECTION 01 53 00

MOLD PREVENTION MEASURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes: Administrative and procedural requirements to help prevent mold contamination in construction.

1.3 SUBMITTALS

A. Reports: Submit reports required in this Section, including but not limited to the following:

1. Sightings of mold.
2. Window and storefront testing.
3. Moisture contents of materials.
4. Exterior sealant cracks, damage, and deterioration.

1.4 QUALITY ASSURANCE

A. Pre-construction Meeting: Review requirements of this Section at Pre-construction Meeting.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Do not bring finish materials into building until building is in a conditioned state. Protect finish materials stored within building. Stage materials off the floor and cover with waterproof covering. Examples of these materials include, but are not limited to, insulation, gypsum products, wall coverings, carpet, ceiling tile, wood products, etc.

C. Remove from Project site damaged materials or materials that have become wet. Do not install such materials.

1.6 PROJECT CONDITIONS

A. Perform daily visual inspections of building for mold. Report sightings of mold to Architect.

B. Remove water found within building during construction immediately.

1. Energize lift stations and sump pumps as early in Project as possible. Use temporary pumps if necessary to get water out of building and drain lines.

C. Ventilation:

1. Verify that HVAC system is providing positive pressure in building.
2. Provide adequate air circulation and ventilation during demolition phase(s).

3. Seal off return air ducts and diffusers to prevent construction dust and moisture from entering occupied areas and HVAC system.

4. Provide temporary outside air ventilation as building becomes enclosed.

D. Maintain clean project site, free from hazards, garbage, and debris.

E. Eating, drinking, and smoking are not permitted within building.

F. Slope perimeter grades, both temporary and final grades, away from building structure.

G. Verify that condensate pans drain properly beginning with initial installation.

H. Flash roof penetrations immediately. Do not allow water to penetrate to floor below.

I. Seal window openings prior to window installation with plastic to prevent moisture entry.

J. Sprayed-on Fireproofing: Keep air moving throughout building when using sprayed-on fireproofing.

K. Cover stored and installed ductwork and installed duct openings with plastic to prevent dust, debris, and moisture from entering ductwork. Repair damaged plastic barrier.

L. Do not operate air handling equipment below 60 degrees F supply air temperature until building is 100 percent enclosed.

M. Monitor humidity and temperature for conformance to installation requirements defined by material and equipment manufacturers.

N. Check moisture content of gypsum board prior to applying finishes. Record findings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Roof Drains: Connect roof drains to risers and storm drainage lines as soon as possible.

B. Floor Drains: Connect floor drains as soon as possible. Do not cover floor drains with tape or other obstructions during construction. Clean out floor drain lines to mains prior to Substantial Completion.

C. Wall Assemblies:

1. Install exterior wall insulation, vapor retarder, and gypsum board only after building is enclosed.

2. Keep bottom of installed gypsum board off floor 1/2 inch.

D. Cavity Conditions: Clean and inspect cavity conditions prior to covering, sealing, or restricting access. Vacuum clean cavity spaces prior to covering or enclosing.

E. Sprayed-On Fireproofing: Remove sprayed-on fireproofing overspray immediately.

F. Plumbing: Pressure test plumbing piping identified as insulated on Project prior to installation of insulation.

G. Roof Mounted Equipment: Inspect rooftop units and other roof-mounted equipment for signs of rain leaks immediately after first rain. Water test with hose immediately after installation. Seal leaks immediately.

H. Windows and Storefront: Water test windows to manufacturer's and Project Manual's specifications. Record findings and forward to Architect.

I. Sealants: Inspect exterior sealants for cracks, damage, or deterioration. Record findings and forward to Architect.

J. HVAC Equipment (Permanent HVAC Equipment Used for Temporary Conditioning of Building During Construction Phases): Change filters and clean ductwork interior to remove dirt, dust, debris, and moisture buildup prior to turning Project over to Owner.

3.2 ADJUSTING

A. Remove damaged materials or materials that have become wet. Replace with new materials.

3.3 DEMONSTRATION

A. Train and educate Owner's maintenance personnel on use of building systems. Explain how improper operation and shutting down systems during off periods can create mold problems.

B. Schedule with Owner a review of building for mold problems at 1year warranty walk-through. Inspect exterior sealants and masonry joints for cracks and other damage or deterioration where water can penetrate building envelope.

C. Explain to Owner the need for Owner to establish annual building review for mold.

END OF SECTION

SECTION 01 57 20

INDOOR AIR QUALITY PLAN DURING CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements to develop and utilize an indoor air quality plan for the construction operation.
2. A sample plan applicable to all interior construction and trades.
3. Reference:
   a. "IAQ Guidelines for Occupied Buildings under Construction", 2nd Edition, 2007, by the Sheet Metal and Air Conditioning Contractors National Association, Inc.

1.2 TRAINING

A. Contractor shall provide copies of the plan and training to all subcontractors and appropriate personnel.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXECUTION

A. Contractor shall utilize a plan to protect the indoor environments from contamination during construction and finish out similar to the following plan.

B. Contractor shall enforce and verify compliance by all personnel and subcontractors.

C. Contractor shall take pictures of the related construction operations to verify conformance to each section of the plan. These pictures will be provided to the Architect. A minimum of 18 pictures (6 pictures taken on three separate occasions) will be submitted. Each set of photos shall be date stamped, highlighting the indoor air protection measures listed in paragraphs 3.2A1a-e, below.

3.2 INDOOR AIR QUALITY PLAN DURING CONSTRUCTION OPERATIONS

A. Introduction

1. This plan outlines the processes required to assure acceptable air quality. Elements of the program include:
   a. HVAC Protection and Containing the work area,
   b. Source Control and Modifying HVAC Operation and Reducing Emissions,
   c. Pathway Interruptions,
   d. Intensifying Housekeeping, and
   e. Scheduling or Relocation of Occupants.

3.3 THESE REQUIREMENTS APPLY TO ALL PARTIES INVOLVED IN DESIGN, CONSTRUCTION, AND BUILDING MOVE IN:

A. CONTAMINANTS

1. Air contaminants include many different materials. These may include; gases, vapors, chemicals, mold/fungus, pathogens, allergens, particulates and radiation. Eliminating all of these is not possible but reducing the introduction and distribution of these contaminants is possible and

desirable. The programs outlined in the following pages is intended to reduce contaminants and provide as clean a building as possible for the residents.

2. The following sections outline procedures and precautions to reduce building contamination and meet the requirements for a healthy environment.

B. CONSTRUCTION OPERATIONS

1. HVAC PROTECTION: The air conditioning system is the distribution method for air and potentially contaminants throughout the building. Keeping the system clean is a necessity.

   a. All air handling equipment, spiral and fabricated ducts and accessories shall be kept clean during transportation, storage and assembly. All equipment, ductwork, and accessories stored on- site shall be raised off of the floor on pallets.

   b. All lined, spiral and assembled ducts shall be wrapped and protected from dirt and water during transportation and storage. All equipment, ductwork, and accessories stored on site shall be raised off of the floor or ground on pallets.

   c. All insulation and lined duct shall be kept dry at all times. Any insulation that has become wet shall be removed and replaced.

   d. Fiberglass duct board in the air handlers and bases shall be kept dry and clean. Exposed fiberglass subject to erosion shall be coated with a sealer to prevent the entry of raw fiberglass into the air stream.

      1) Water will not be allowed to stand on any mechanical equipment.

   e. All open ends of installed duct and equipment shall be covered and sealed to prevent the entry of dirt.

   f. All zone boxes shall be wrapped and sealed from dirt and water before installation. Installed zone boxes shall have the openings sealed until permanently connected to the ductwork.

   g. All dampers and attenuators into open chases and ducts shall be covered to reduce dirt entry.

   h. The air handlers shall not be started without MERV 8 filtration in place. Upon system activation, install sheet media on all return openings and filters in zone box plenum openings. These filters must be monitored and changed as necessary to prevent the entry of dirt into the system. The temporary media shall be removed after building flush out and before occupancy.

   i. The return air system should not be used during sheet rock installation, sanding or painting operations.

   j. The building should be kept under a positive pressure as much as possible.

   k. Chase dampers shall be kept closed until the system is activated.

   l. Complete the initial mechanical checklists at system startup.

   m. Replace final filters with new filters before flushing out or occupancy per design requirements.

2. SOURCE CONTROL

   a. No smoking or tobacco materials shall be allowed in the building.

   b. No gasoline or fuel fired equipment shall be used inside any enclosed building.

   c. Wet processes within the building shall be kept to a minimum.

   d. All chase and wallboard materials shall be protected from water. All damaged materials shall be removed and replaced.

   e. Use low emission materials and chemicals.

   f. All cleaning involving chemicals shall be performed outside the building wherever possible.

   g. All carpet materials shall be unrolled or unboxed and aired out in a well-ventilated warehouse for a minimum of three days before installation unless the carpet meets the requirements of The Carpet and Rug Institute (CRI) Green label Plus program and the cushion meets the requirements of The Carpet and Rug Institute (CRI) Green label

program. Carpet and cushion should be installed a minimum of three days prior to conducting indoor air quality testing. carpet materials shall be unrolled or unboxed and aired out in a well-ventilated warehouse for a minimum of three days before installation.

h. All modular furniture shall be aired out in a well-ventilated warehouse for seven days before entry into the building unless the modular furniture is Greenguard® certified.

i. Trash shall be cleaned up and removed daily to the appropriate recycle container.

j. Any mold growth shall be treated according to the procedures shown in the New York City Department of Health “Guidelines on Assessment and Remediation of Fungi in Indoor Environments.

k. Clean the inside of all walls at the base track to remove excess materials and dirt with a vacuum cleaner before enclosing the wall. This is particularly critical on walls with plumbing or water piping included.

l. HEPA vacuum all concrete floors before installation of floor covering materials.

m. No obvious mold or chemical contamination shall be enclosed, hidden or painted.

3. PATHWAY INTERRUPTION

a. Dust producing operations shall be exhausted to the outside to the extent possible.

b. Exhaust fans may be installed on each floor to remove dust and contaminants.

c. The air handler shall supply conditioned air to the floors. Floors with heavy dust or chemical operations shall be exhausted to the outside.

d. During rain or high humidity conditions, the air supply coming from the coils shall be cooled to 55 degrees F or the air handler stopped to prevent moist air entry into the building. Exhaust fans shall not draw moist air into the building. It is preferable to have little airflow to moist air entering the building.

e. Return air dampers and openings shall be covered with filter media during operations that may contaminate the system.

4. HOUSEKEEPING

a. Food or food residues shall be properly disposed after meals or breaks.

b. Once the building is enclosed with finishes applied, keep dirt entry to a minimum with walk off mats at all entrances. Clean the mats at least daily.

c. All sweeping shall be done with dust reducing wax-based sweeping compounds.

d. All materials shall be kept clean and stored neatly on dunnage or pallets as required by the manufacturer.

e. Coils, fans, and air handler chambers including return air chambers shall be inspected and cleaned if required before starting up, final testing and commissioning, and air testing.

f. All workers shall utilize the proper personal protective equipment per OSHA standards during any operation involving chemicals and dust production.

g. No food, drink, or smoking shall be allowed within the building after the building is enclosed.

5. SCHEDULING

a. Complete all dust producing and chemical operations before the installation of “sink” materials such as carpet and ceiling tile.

b. Complete the HVAC control system sufficient to allow the operation of the supply and exhaust systems to control pressurization and contaminants.

c. Group contaminating operations where possible to maximize exhaust use.

END OF SECTION

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.

1.3 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 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.

1.6 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.

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.

B. 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. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

b. Non-restricted 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. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

b. Non-restricted 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.

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

on whether a proposed product matches the sample.

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.

D. 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

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. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 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. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

D. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous

materials, for hazardous waste disposal.

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

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

1.5 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. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

a. Primary operational systems and equipment.

b. Fire separation assemblies.

c. Air or smoke barriers.

d. Fire-suppression systems.

e. Mechanical systems piping and ducts.

f. Control systems.

g. Communication systems.

h. Fire-detection and -alarm systems.

i. Conveying systems.

j. Electrical wiring systems.

k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

a. Water, moisture, or vapor barriers.

b. Membranes and flashings.

c. Exterior curtain-wall construction.

d. Sprayed fire-resistive material.

e. Equipment supports.

f. Piping, ductwork, vessels, and equipment.

g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

C. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

D. 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 requirements in Section 01 81 13.13 "Sustainable Design Requirements

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

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. Field Measurements: Take field measurements as required to fit the Work properly. Re-check 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.

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

C. 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 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 at each story of construction and elsewhere 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 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, column grids, and floor levels, 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.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, 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. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect 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 in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

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

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

G. 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.

H. 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.

I. 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.

J. 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 minimize 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 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 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.

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 19 "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.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 91 13 "General Commissioning Requirements."

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

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

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.10 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.

END OF SECTION

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 construction waste.
2. Recycling nonhazardous waste.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

C. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

D. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 REFERENCES

A. ASTM E 1609 Standard Guide for Development and Implementation of a Pollution Prevention Program.

B. LEED v4.0: Leadership in Energy and Environmental Design Version 4.0.

C. USGBC: U. S. Green Building Council.

1.5 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of percentage required by LEED v4.0 or similar Green Building Requirements, by weight of total non- hazardous solid waste generated by the Work. 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 recycling and salvage of materials, including the following:

1. Demolition Waste:
    a. Asphalt paving.
    b. Concrete.
    c. Concrete reinforcing steel.
    d. Brick.
    e. Concrete masonry units.
    f. Rough hardware.
    g. Roofing.
    h. Insulation.
    i. Doors and frames.

j. Door hardware.

k. Windows.

l. Glazing.

m. Metal studs.

n. Gypsum board.

o. Acoustical tile and panels.

p. Carpet.

q. Carpet pad.

r. Equipment.

s. Cabinets.

t. Plumbing fixtures.

u. Piping.

v. Supports and hangers.

w. Valves.

x. Sprinklers.

y. Mechanical equipment.

z. Refrigerants.

aa. Electrical conduit.

bb. Copper wiring.

cc. Lighting fixtures.

dd. Lamps.

ee. Ballasts.

ff. Electrical devices.

gg. Switchgear and panelboards.

hh. Transformers.

2. Construction Waste:

a. Masonry and CMU.

b. Lumber.

c. Wood sheet materials.

d. Wood trim.

e. Metals.

f. Roofing.

g. Insulation.

h. Carpet and pad.

i. Gypsum board.

j. Piping.

k. Electrical conduit.

l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.

2) Cardboard.

3) Boxes.

4) Plastic sheet and film.

5) Polystyrene packaging.

6) Wood crates.

7) Plastic pails.

1.6 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.7 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.

4. Quantity of waste salvaged, both estimated and actual in tons.

5. Quantity of waste recycled, both estimated and actual in tons.

6. Total quantity of waste recovered (salvaged plus recycled) in tons.

7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. 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.

G. Qualification Data: For waste management coordinator.

1.8 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED-Accredited Professional, certified by the USGBC, as waste management coordinator. Waste management coordinator may also serve as LEED coordinator.

B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Waste Management 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 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 procedures for periodic waste collection and transportation to recycling and disposal facilities.

5. Review waste management requirements for each trade.

1.9 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E1609 and 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 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, recycled, 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. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

2. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.

2. Revenue from salvaged materials.

3. Revenue from recycled materials.

4. Savings in hauling and tipping fees by donating materials.

5. Savings in hauling and tipping fees that are avoided.

6. Handling and transportation costs. Include cost of collection containers for each type of waste.

7. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

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: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.

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, recycling, 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, recycled, reused, donated, and sold.

2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 RECYCLING WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by Owner and Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.

4. Store components off the ground and protect from the weather.

5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

END OF SECTION

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.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: 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. Submittal of Project Warranties.

D. 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 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 Architect. 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 Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.

6. Submit sustainable design submittals required in Section 01 81 13.14 "LEED Requirements," and in individual Sections.

7. 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 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 heat and other utilities.

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 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect 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 items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection 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.

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 according to Section 01 29 00 - Payment Procedures.

2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (i.e. punch list), endorsed and dated by Architect. Certified copy of the 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 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect 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. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (i.e. 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.

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.

d. Name of Contractor.

e. Page number.

4. Submit list of incomplete items in the following format:

a. MS Excel electronic file. Architect will return annotated file.

b. PDF electronic file. Architect 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. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

4. 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.

C. 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.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

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. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

j. 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.

k. Remove labels that are not permanent.

l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

o. 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.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.

q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 0150 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

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 specify 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

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.

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 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 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 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 Architect.
7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
8. 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

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.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit one set of marked-up record prints.
2. Number of Copies: Submit copies of record Drawings as follows:
   a. Initial Submittal:
      1) Submit record digital data files and one set(s) of plots.
      2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
   b. Final Submittal:
      1) Submit one paper-copy set(s) of marked-up record prints.
      2) Submit record digital data files and three set(s) of record digital data file plots.
      3) Plot each drawing file, whether or not changes and additional information were recorded.

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] 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 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. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
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 for resolution.
4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
    a. See Section 01 33 00 "Submittal Procedures" for requirements related to use of Architect's digital data files.

b. 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 sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

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.

e. Name of Contractor.

2.2 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 scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 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 scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 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 scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

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:

1. Store record documents and Samples in the field office apart from the Contract Documents used for construction.

2. Do not use project record documents for construction purposes.

3. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss.

4. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION

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. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. 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 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. Pre-instruction 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.

1.5 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.

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 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. 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.

END OF SECTION

SECTION 02 41 13

SELECTIVE DEMOLITION

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 the following:

1. Demolition and removal of selected site elements, building and other improvements indicated on Drawings or as required for new construction of the Project.

2. Demolition and removal of existing paving, curbs, sidewalks, and adjacent landscape work to limits indicated on Drawings or required for new construction of the Project.

B. Items of interest or value to Owner that may be encountered during selective demolition shall remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

1.3 REFERENCES

A. American National Standard Institute (ANSI):

1. ANSI A 10.6 “Demolition, Safety Requirements”

B. National Fire Protection Association (NFPA)

1. NFPA 241 “Standard for Safeguarding Construction, Alteration, and Demolition Operations”

1.4 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.5 INFORMATIONAL SUBMITTALS

A. General: Submit the following under provisions of Section 01 33 00.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Interruption of utility services. Indicate how long utility services will be interrupted.

2. Coordination for shut-off, capping, and continuation of utility services as required.

3. Owner’s On-Site Operations: Provide a detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's off-site operations.

4. Means of protection for items to remain and items in path of waste removal from site.

C. Qualification Data: Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Architects and Owners, and other information specified.

D. Pre-demolition Photographs or Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective

demolition operations. Comply with Division 01 Section "Photographic Documentation." Submit before Work begins.

E. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

F. Closeout Submittals: Record documents, indicating locations of encountered items, whether currently in use or abandoned in place.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Contractor: Contractor is responsible for quality control of the Work.

2. Demolition Firm: A firm experienced in successfully demolition and removal of work similar to that indicated for this Project, with a record of successful performance, and with sufficient capacity to provide demolition, removal, and legal disposal of debris without causing delay in the Work.

B. Regulatory Requirements: Comply with all applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary approvals from all such authorities.

1. Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

2. Comply with ANSI A 10.6, Safety and Health Program Requirements for Demolition Activities and NFPA 241, Standard for Safeguarding Construction, Alteration and Demolition Operations.

C. Pre-plan demolition Work to minimize interruption or disruption to Owner’s or adjoining tenant’s ongoing operations.

D. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to selective demolition.

1.7 PROJECT CONDITIONS OR SITE CONDITIONS

A. Environmental Requirements: Proceed with the Work in accordance with governmental requirements.

B. Condition of Site Elements: Owner assumes no responsibility for actual condition of site elements to be demolished.

1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner insofar as practicable. However, variations may occur by Owner's removal and salvage operations prior to start of demolition work.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Recycled Materials:

1. Items of recycled value to Contractor may be removed from structure as work progresses.

2. Recycled items shall be transported from site as they are removed.

3. Comply with governing regulations pertaining to environmental protection.

E. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Owner. Owner will retain a qualified Testing Agency under a separate contract.

2. Suspected materials shall be tested and analysis reports will be provided by a qualified testing agency retained by the Owner.

3. Hazardous materials will be removed from the site by an approved hazardous materials remediation company, retained by Owner under a separate contract.

F. Explosives: Use of explosives will not be permitted.

G. Traffic:

1. Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

H. Protections: Ensure safe passage of persons around areas of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.

1. Erect temporary covered passageways as required by authorities having jurisdiction.

2. Provide shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

3. Cover and protect all existing improvements in areas affected by demolition activities prior to commencement of activities.

I. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

J. Utility Services: Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

K. Utility Services: Refer to applicable Sections for disconnecting, removal, and capping of utility services. Do not start demolition work until utility disconnections have been completed and verified in writing.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

A. General:

1. Protect and maintain benchmarks and survey control pints from disturbance during construction activities.

2. Protect existing improvements to remain during construction activities.

3.2 RESTORATION

A. General:

1. Restore any existing improvements which are damaged during construction activities to their original condition, as determined to be acceptable by the Owner.

3.3 EXAMINATION

A. Verify that utilities have been disconnected and capped.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect and Owner.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and preconstruction videotapes.

1. Comply with requirements specified in Division 01 Section "Photographic Documentation.

3.4 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.

1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary of Work."

2. Do not proceed with utility service interruption without permission of Owner and utility company affected. Notify Owner and utility company affected a minimum of seven work days prior to required interruption.

B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.

2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.5 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of existing adjacent buildings.

C. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of demolition.

D. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. Comply with governing regulations pertaining to environmental protection.

1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding or pollution to storm drains.

3.6 DEMOLITION

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work in accordance with ANSI A10.6, NFPA 241 and within limitations of governing regulations and as follows:

1. Proceed with demolition in systematic manner, from top of structure to ground. Complete demolition work above each floor or tier before disturbing supporting members on lower levels.

2. Demolish concrete and masonry in small sections.

3. Break up and remove concrete slabs-on-grade, unless otherwise shown to remain.

B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition activities.

C. Below-Grade Construction:

1. Demolish and remove below-grade construction and concrete slabs on grade.

2. Filling Basements and Voids: Completely fill below-grade areas and voids resulting from demolition of structures.

3. Use satisfactory soil materials consisting of stone, gravel, and sand, free from debris, trash, frozen materials, roots and other organic matter.

4. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen material, trash and debris.

5. Place fill materials in horizontal layers not exceeding 6" in loose depth. Compact each layer at optimum moisture content of fill material to a density equal to original adjacent ground, unless subsequent excavation for new work is required.

6. After fill placement and compaction, grade surface to meet adjacent contours and to provide flow to surface drainage structures.

3.7 SITE IMPROVEMENTS

A. General:

1. Remove existing above-grade and below -grade improvements as indicated and as necessary to facilitate new construction required by the Project.

2. Remove slabs, paving, curbs and gutters as indicated or required for new construction. Where concrete slabs, curbs, gutter and asphalt pavements are indicated to be removed, remove base and subbase materials to surface underlying, undisturbed soil.

3. Where existing full-depth joints do not coincide with the line of pavement demolition, saw-cut pavement to full depth the length of existing pavement to remain before removing existing pavement, Saw-cut faces vertically.

4. Remove driveways, curbs, gutters and sidewalks by saw cutting to full depth. If saw-cut falls with 30-inches of a construction joint, expansion joint, score mark or edge, remove material to joint, score mark or edge.

3.8 BACKFILL

1. Filling Basements and Voids: Completely fill below-grade areas and voids resulting from demolition of structures.

2. Use satisfactory soil materials consisting of stone, gravel, and sand, free from debris, trash, frozen materials, roots and other organic matter.

3. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen material, trash and debris.

4. Place fill materials in horizontal layers not exceeding 6-inches in loose depth. Compact each layer at optimum moisture content of fill material to a density equal to original adjacent ground, unless subsequent excavation for new work is required. Coordinate with Section

5. After fill placement and compaction, grade surface to meet adjacent contours and to provide flow to surface drainage structures.

3.9 DISPOSAL & RECYCLING OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain as the Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill or recycle center.

1. Do not allow demolished materials to accumulate on-site.

2. Remove and transport debris in a lawful manner that will prevent spillage on adjacent surfaces and areas.

B. Separate recyclable materials produced during demolition activities from non-recyclable materials. Store or stockpile with intermixing with other materials and transport them to recycling facility. Coordinate recording requirements with Division 01 “Sustainable Design Requirements” and Section 01 74 19 “Construction Waste Management and Disposal”.

C. At the end of each workday, remove unused materials, debris and containers from the site.

D. Burning of removed materials from demolished structures will not be permitted on site.

E. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

F. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations.

G. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 03 35 43

POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes polished concrete finishing, including staining.
   1. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 033000 "Cast-in-Place Concrete."

1.2 DEFINITIONS

A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

1.3 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 polished 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. Cast-in-place concrete subcontractor.
      e. Polished concrete finishing Subcontractor.
   2. Review cold- and hot-weather concreting procedures, curing procedures, construction joints, concrete repair procedures, concrete finishing, and protection of polished concrete.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Polishing Schedule: Submit plan showing polished concrete surfaces and schedule of polishing operations for each area of polished concrete before start of polishing operations. Include locations of all joints, including construction joints.

C. Samples for Initial Selection: For each type of product requiring color selection.

D. Samples for Verification: For each type of exposed color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Repair materials.
   2. Stain materials.
   3. Liquid floor treatments.

1.6 QUALITY ASSURANCE

A. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches (1200 by 1200 mm) minimum, to demonstrate the expected range of finish, color, and appearance variations.
   1. Locate panels as indicated or, if not indicated, as directed by Architect.
   2. Maintain field sample panels during construction in an undisturbed condition as a standard for judging the completed Work.
   3. Demolish and remove field sample panels when directed.

1.7 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 STAIN MATERIALS

A. Penetrating Dye: Penetrating translucent dye concentrate to color new and existing interior concrete surfaces prior to polishing.
   1. Color: Refer to Section 011010 "Design Selections."

2.2 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.
   1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to the following:
      a. Advanced Floor Products; RetroPlate Concrete Polishing System (VOC: 0 g/L).
      b. ARDEX Americas; ARDEX PC 50 (VOC: <50 g/L).
      c. Euclid Chemical Company (The); an RPM international company; ARDEX PC 50 (VOC: <50 g/L).
      d. Laticrete International, Inc.; FGS Permashine (VOC: 0 g/L).
      e. NewLook International, Inc.; NanoSet Densifier LI (VOC: 0 g/L).
      f. PROSOCO, Inc.; Consolideck Blended Densifier (VOC: 0 g/L).
      g. QuestMark, a division of CentiMark Corporation; DiamondQuest.
      h. Vexcon Chemicals Inc.; Cerit-shine Clear (VOC: 0 g/L).

PART 3 - EXECUTION

3.1 POLISHING

A. Polish: Level 1: Matte finish, 100 grit.

B. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.
   1. Machine grind floor surfaces to receive polished finishes level and smooth.
   2. Apply dye for polished concrete in polishing sequence and according to manufacturer's written instructions.
   3. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
   4. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
   5. Control and dispose of waste products produced by grinding and polishing operations.
   6. Neutralize and clean polished floor surfaces.

3.2 STAINING

A. Newly placed concrete shall be at least 30 days old before applying dye.

B. Prepare surfaces according to manufacturer's written instructions and as follows:
   1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
      a. Do not use acidic solutions to clean surfaces.
   2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by acid etching and grinding, sanding, or abrasive blasting as required by manufacturer of dye and liquid floor treatments. Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.
   3. Apply acidic solution to dampened concrete surfaces, scrubbing with uncolored, acid-resistant nylon-bristle brushes until bubbling stops and concrete surface has texture of 120-grit sandpaper. Do not allow solution to dry on concrete surfaces. Rinse until water is clear. Control, collect, and legally dispose of runoff.

4. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F 710 to ensure pH is between 7 and 8.

C. Allow concrete surface to dry before applying stain. Verify readiness of concrete to receive stain according to ASTM D 4263 by tightly taping 18-by-18-inch (450-by-450-mm), 4-mil- (0.1-mm-) thick polyethylene sheet to a representative area of concrete surface. Apply stain only if no evidence of moisture has accumulated under sheet after 16 hours.

D. Penetrating Dye: Apply penetrating dye to concrete surfaces according to manufacturer's written instructions.
   1. Allow to dry four hours and repeat application of dyein sufficient quantity to obtain color consistent with approved mockup.
   2. Rinse until water is clear. Control, collect, and legally dispose of runoff.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL 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. Exterior load bearing and non-load-bearing wall framing.
   2. Soffit framing.
   3. Delegated Design requirements for structural engineering design and analysis.

1.3 ACTION SUBMITTALS

A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.
B. Product Data: For each type of cold-formed steel product and accessory.
C. Delegated Design: Design cold-formed metal framing system including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria as indicated, or required by adopted Building Code for the Project.
   1. For installed products and components indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation, licensed to practice in the project location.
   2. Shop Drawings sealed by the qualified professional engineer responsible for their preparation, licensed to practice in the project location.
D. Shop Drawings:
   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
E. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation, licensed to practice in the project location.

1.4 INFORMATIONAL SUBMITTALS

A. Sustainable Documentation Submittals:
   1. Recycled Content:
      a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
      b. Include statement indicating costs for each product having recycled content.
   2. Regional Material:
      a. Product data for regional materials (within 500 miles of construction site) indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.
      b. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
      c. For metal products, provide statement from manufacturer indicating location for scrap collection and other recycled materials include in the product and its distance from the project site.

1.5 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
B. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.6 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site in accordance with Section 01 31 00 ”Project Management and Coordination” .

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ClarkWestern Building Systems, Inc.
   2. Dietrich Metal Framing; a Worthington Industries Company.
   3. MarinoWARE.
   4. Nuconsteel; a Nucor Company.
   5. Steel Network, Inc. (The).

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: As indicated.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
      a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 supporting EIFS and ACM veneer; 1/360 supporting cement plaster veneer; 1/600 supporting masonry veneer of the wall height.
      b. Soffit Framing: Vertical deflection of 1/240 of the span for live loads and 1/240 for total loads of the span.
   3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
   4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
      a. Upward and downward movement of 3/4 inch.
   5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Design Standards:
   1. Floor and Roof Systems: AISI S210.
   2. Wall Studs: AISI S211.
   3. Headers: AISI S212.
   4. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 20 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance
   2. Coating: G60 typical andG90 in coastal areas

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60 typical and G90 in coastal areas.

2.4 EXTERIOR LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with

stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Minimum Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Minimum Flange Width: 1-1/4 inches.

C. Steel Box or Back-to Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Minimum Flange Width: 1-5/8 inches.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Minimum Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Minimum Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ClarkWestern Building Systems, Inc.
b. Dietrich Metal Framing; a Worthington Industries company.
c. MarinoWARE.
d. Steel Network, Inc. (The).

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Minimum Flange Width: 1 inch plus twice the design gap for other applications.

2.6 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Flange Width: 2 inches, minimum.

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
F. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS
A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
B. Shims: Load bearing, high-density multi-monomer plastic, and non-leaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.10 FABRICATION
A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
C. Fabrication Tolerances: Fabricate all assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine supporting substrates and abutting structural framing 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 PREPARATION
A. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL
A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
   1. Cut framing members by sawing or shearing; do not torch cut.
   2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
      a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
      b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 EXTERIOR LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and end and at spacing as follows:
   1. Anchor Spacing: As shown on Shop Drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding 1/8-inch between the end of the wall framing member and the web of the track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
   1. Stud Spacing: As required by design, but not more than 16 inches unless noted otherwise.

C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

F. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners or gusset plates.
   1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
   2. Install runner tracks and jack studs above and below openings. Anchor tracks to jamb studs with clip angles or by welding and space jack studs same as full-height wall studs.

G. Install supplementary framing, blocking and bracing in stud framing indicated or required to support fixtures, equipment, casework, heavy trim, furnishings and similar work requiring attachment to framing.
   1. If type of supplementary framing is not indicated comply with stud manufacturer’s written recommendations and industry standards in each case, considering weight or load resulting from item supported.

H. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.

I. Install steel sheet diagonal bracing straps to both stud flanges. Terminate at and fasten to reinforced top & bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

J. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: As required by design, but not more than 16 inches unless noted otherwise.
C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar configurations.
D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install single deep-leg deflection tracks and anchor to building structure.
   2. Connect vertical deflection clips to bypassing studs and anchor to building structure.
E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
   1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within18 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
      a. Install solid blocking at centers indicated.
   2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
   3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner shall engage a qualified independent testing and inspecting agency to perform field tests and special inspections and prepare test reports.
   1. Test and inspect as required by the Building Code, 2015 IBC, Section1705.
B. Field and shop welds will be subject to testing and inspecting.
C. Testing agency will report test results promptly and in writing to Contractor and Architect.
D. Prepare test and inspection reports in accordance with provisions of Section 01 40 00 “Quality Requirements”.
E. Remove and replace work where test results indicate that it does not comply with specified requirements.
F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 06 10 53

MISCELLANEOUS ROUGH CARPENTRY

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.

1.3 DEFINITIONS

A. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

B. Lumber grading agencies, and the abbreviations used to reference them, include the following:
   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NHLA: National Hardwood Lumber Association.
   3. NLGA: National Lumber Grades Authority.
   4. SPIB: The Southern Pine Inspection Bureau.
   5. WCLIB: West Coast Lumber Inspection Bureau.
   6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.

B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
   4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
   5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.5 INFORMATIONAL SUBMITTALS

A. Sustainable Documentation Submittals:
   1. Regional Material:
      a. Product data for regional materials (within 500 miles of construction site) indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.
      b. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
      c. For metal products, provide statement from manufacturer indicating location for scrap collection and other recycled materials include in the product and its distance from the project site.
   2. Certified Wood:
      a. Product data and chain-of-custody certificates for products containing certified wood.
      b. Provide invoices for all permanently installed wood on the project, whether FSC-Certified or not. Invoices must indicate product name, product manufacturer, product cost, FSC status and Chain-of-Custody number for vendor.
   3. VOC content data. Provide for any adhesives, sealants, paints, or coatings used on the interior of the building.
      a. Product information or statement from manufacturer indicating the VOC content of the product in grams per liter (g/L).
   4. No Added Urea-Formaldehyde (NAUF) data. Provide for any permanently installed composite wood used on the interior of the building:
      a. Product information or statement from manufacturer indicating that the product has No Added Urea-Formaldehyde (NAUF).
      b. Product information or statement from manufacturer indicating that composite wood or

agrifiber products or adhesives used to fabricate the product have No Added Urea-Formaldehyde (NAUF).

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation.

B. Protect lumber from weather by covering with waterproof sheeting, securely anchored.

C. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

C. VOC Limits: Any adhesives, sealants, paints, or coatings shall meet the VOC limits indicated in Section 01 81 13.

D. Required Certification: A minimum of 50% of wood, calculated by cost, shall be obtained from forests certified by an FSC accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

E. Required Certification: Composite wood products shall contain No Added Urea-Formaldehyde (NAUF) in the product or laminating adhesives used to fabricate the product.

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawl spaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not

indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841

C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.

E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all miscellaneous carpentry unless otherwise indicated.
1. Concealed blocking.
2. Roof framing and blocking.
3. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
4. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.

B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
1. Mixed southern pine; SPIB.

C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
1. Spruce-pine-fir (south) or spruce-pine-fir, Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used if it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing

panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.

E. Do not splice structural members between supports unless otherwise indicated.

F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

G. Provide fire-retardant-treated wood fireblocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
   1. Provide fireblocking in furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or non-combustible materials accurately fitted to close furred spaces.
   2. Provide fireblocking in concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fireblocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2- inch nominal thickness.
   3. Provide fireblocking in concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
   4. Provide fireblocking in concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

H. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. NES NER-272 Technical Bulletin for power-driven fasteners.
   2. Table 2304.10.1, "Fastening Schedule," in currently adopted (2015) International Building Code.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION

SECTION 06 41 16

PLASTIC LAMINATE-FACED ARCHITECTURAL CABINETS

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. Plastic-laminate-faced architectural cabinets.
   2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.
   3. Stainless Steel prefabricated legs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
   4. Apply AWI Quality Certification Program label to Shop Drawings.

D. Samples for Initial Selection:
   1. Plastic laminates.
   2. PVC edge material.
   3. Thermoset decorative panels.

E. Samples for Verification:
   1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish and specified edge material applied to one edge.
   2. Corner pieces as follows:
      a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
      b. Miter joints for standing trim.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of product.

B. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.

B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups of typical plastic-laminate cabinets as shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in

areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Section 087100 "Door Hardware" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. Required Certification: Composite wood products shall contain No Added Urea-Formaldehyde (NAUF) in the product or laminating adhesives used to fabricate the product.

2.2 ARCHITECTURAL CABINET FABRICATORS

A. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brochsteins, Inc.
2. Robert Shaw Mfg. Co., Inc.
3. Environment Limited.
4. CRC Mastercraft, LLC, Khoury.

2.3 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.

1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

B. Grade: Custom

C. Type of Construction: Frameless.

D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.

E. Core Material:

1. Exposed casework in non-wet areas: Medium-density fiberboard, Type A
2. Semi-exposed casework in typical areas: Thermoset Decorative Laminate
3. All casework in semi-wet areas: Medium-density fiberboard, Type B
4. All casework in wet areas: Medium-density fiberboard, Type C

F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Abet Laminati, Inc.
   b. Formica Corporation.
   c. Lamin-Art, Inc.
   d. Panolam Industries International, Inc.
   e. Wilsonart International; Div. of Premark International, Inc.

G. Laminate Cladding for Exposed Surfaces:
   1. Horizontal Surfaces: Grade HGS.
   2. Vertical Surfaces: Grade VGS.
   3. Edges: Grade HGS.
H. Edge banding for Plastic Laminate Clad Cabinets: Rigid PVC extrusions, through color with satin finish, 3 mm thick at counter tops, doors, drawer fronts, and exposed shelving on front and back edges (front edge only for fixed shelving); and 1 mm thick elsewhere, including edges of shelving within cabinets
I. Materials for Semi-exposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade CLS.
      a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inchminimum thickness, matching laminate in color, pattern, and finish.
      b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
      c. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
   2. Drawer Sides and Backs: Solid-hardwood lumber.
   3. Drawer Bottoms: Hardwood plywood
J. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
K. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
L. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
   1. Join subfronts, backs, and sides with glued dovetail joints.
M. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
   1. As indicated by laminate manufacturer's designations.

2.4 WOOD MATERIALS
A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Wood Moisture Content: 5 to 10 percent.
B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
   1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
   2. Particleboard: ANSI A208.1, Grade M-2, made with binder containing no urea formaldehyde.
   3. Softwood Plywood: DOC PS 1.
   4. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.5 CABINET HARDWARE AND ACCESSORIES
A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."
B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.
C. Wire Pulls: Back mounted, solid[metal, 4 inches long, 5/16 inch in diameter
D. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
E. Shelf Rests: BHMA A156.9, B04013; metal.
F. Drawer Slides: BHMA A156.9.
   1. Grade 1 and Grade 2: Side mounted full-extension type; zinc-plated steel with polymer rollers.
   2. Grade 1HD-100 : Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
   3. File Drawer Slides:
      a. Integrated drawer slide and side panel, full extension, self-closing feature with 2-5/8 inches (60 mm) self-closing range, built-in drawer front adjustment and bumpers, smooth, quiet travel, white baked-on epoxy finish.
      b. Basis of Design - 1HD-100: Zargen Grass; Unigrass System 6036.
   4. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 2.
      a. Pencil Drawer Slides:
         1) Basis of Design: Zargen Grass; Unigrass System.
   5. For drawers more than 3 inches high but not more than 6 inches high and not more than 24 inches

wide, provide Grade 1.
6. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
7. File Drawer Slides: Full extension member and file railing system.
8. For computer keyboard shelves, provide Grade 1
9. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-100].

G. Door Locks: BHMA A156.11, E07121.
H. Drawer Locks: BHMA A156.11, E07041.
I. Door and Drawer Silencers: BHMA A156.16, L03011.
J. Hanging Rail System for Wall Cabinets:
1. Hafele; Item No. 290.11.901 Wall and Rail and Suspension Fitting, Item No. 290.00.700 and 701.
K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Stainless Steel: BHMA 630.
L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
M. Prefabricated stainless steel legs as shown on drawings. Webstaurant Store or equal.

2.6 MISCELLANEOUS MATERIALS
A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
C. Adhesives: Do not use adhesives that contain urea formaldehyde.
D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.7 FABRICATION
A. Fabricate cabinets to dimensions, profiles, and details indicated.
B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION
A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION
A. Grade: Install cabinets to comply with same grade as item to be installed.
B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
1. Use filler matching finish of items being installed.
F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.

Complete installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish] [toggle bolts through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semi-exposed surfaces.

END OF SECTION

SECTION 06 64 00

PLASTIC PANELING (FRP)

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. Plastic sheet paneling for use in janitor closets and elsewhere as indicated.

1.3 ACTION SUBMITTALS

A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.
B. Product Data: For each type of product.
C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size to indicate trim, base and spline trim installation.
   2. Show locations and sizes of blocking and nailers, including concealed blocking and reinforcement specified in other Sections where required to secure trim pieces.
D. Samples for Initial Selection: For plastic paneling and trim accessories.
E. Samples for Verification: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 INFORMATIONAL SUBMITTALS

A. Sustainable Documentation Submittals:
   1. Recycled Content:
      a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
      b. Include statement indicating costs for each product having recycled content.
   2. Regional Material:
      a. Product data for regional materials (within 500 miles of construction site) indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.
      b. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
      c. For metal products, provide statement from manufacturer indicating location for scrap collection and other recycled materials include in the product and its distance from the project site.
   3. VOC content data. Provide for any adhesives, sealants, paints, or coatings used on the interior of the building.
      a. Product information or statement from manufacturer indicating the VOC content of the product in grams per liter (g/L).

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
B. Field Measurements: Where FRP is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
   1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.
   2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating FRP without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.
      a. Do not install materials that are wet, moisture damaged, or mold damaged. Indications that materials are wet, or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

b. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.6 COORDINATION

A. Coordinate sizes and locations of framing, blocking, reinforcements, and other related units of Work specified in other Sections to ensure that exterior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. VOC Limits: any adhesives, sealants, paints, or coatings shall meet the VOC limits indicated in Section 01 81 14.

2.2 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.3 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319. Panels shall be USDA accepted for incidental food contact.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Crane Composites, Inc.
      b. Marlite.
      c. Nudo Products, Inc.
   2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 450 or less.
   3. Nominal Thickness: Not less than 0.075 inch.
   4. Surface Finish: Molded pebble texture.
   5. Color: As selected from manufacturer's full range.

2.4 ACCESSORIES

A. Trim Accessories: Manufacturer's standard two-piece, snap-on vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
   1. Color: Match panels.
B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
D. Adhesive: As recommended by plastic paneling manufacturer and with a VOC content of 50 g/L or less.
E. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 92 00 "Joint Sealants."
   1. Sealant shall have a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, 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 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

1. Mark plumb lines on substrate at trim accessory and panel joint locations for accurate installation.
2. Locate trim accessories and panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.
B. Install panels in a full spread of adhesive.
C. Install trim accessories with adhesive. Do not fasten through panels.
D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
G. Remove excess sealant and smears as paneling is installed.
H. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 07 01 53

ROOF MODIFICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes the following:

1. Modifications to existing roofing system in preparation for tie-in with new adjacent compatible roofing system.
2. Patching of existing roofing system where existing openings are no longer required.
3. Cutting in of new penetrations through existing roof system and flashing with new materials into existing roofing system.
4. Protection of existing roofing system that is not to be modified or disturbed.

1.2 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

1.3 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Existing Membrane Roofing System: Roofing membrane, surfacing, and components and accessories between deck and roofing membrane.

C. Substrate Board: Rigid board or panel products placed over the roof deck that serve as thermal barriers, provide a smooth substrate, or serve as a component of a fire-resistance-rated roofing system.

D. Partial Roof Tear-Off: Removal of a portion of existing membrane roofing system from deck or removal of selected components and accessories from existing membrane roofing system.

E. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and reinstalled.

F. Existing to Remain: Existing items of construction that are not indicated to be removed.

1.4 SYSTEM DESCRIPTION

A. Designated Roof Areas: Remove existing ballast (if any), perimeter flashings, base flashings, counter flashings, vent stack flashings, roofing membrane, insulation, and other system components as required for roofing work.

B. Remove or relocate designated roof mounted mechanical and electrical equipment as required for roofing work.

C. Provide products required by manufacturers to be fully compatible with each other and with indicated substrates, or provide separation materials as required to eliminate contact between incompatible materials.

D. Provide new roof membrane, insulation, and flashing to accommodate roof mounted equipment removal or relocation, penetrations, and new building addition.

E. Performance Requirements: Prevent water infiltration through roof membrane penetrations or modifications resulting from work described in Contract Documents.

F. Industry Standards: Conform to NRCA - Roofing and Waterproofing Manual, except where more stringent requirements are indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product specified.

1. Include list of materials and data sheets describing physical characteristics and performance criteria for materials proposed for use as well as applicable standards met by each product.

B. Shop Drawings: Submit details for this specific project indicating construction at penetrations, terminations, flashings, drains, and tie-in to existing roof.

1.6 INFORMATIONAL SUBMITTALS

A. Photographs or Video: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces, that might be misconstrued as having been damaged by roofing modification operations. Submit before Work begins.

B. Certifications specified in Quality Assurance article.

C. Qualification Data: For Installer, including certificate that Installer is approved by warrantor of existing roofing system.

D. Manufacturer's Installation Instructions: Submit manufacturer's printed installation instructions for each product.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 01.

B. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roof installation.

C. Warranty: Submit specified warranty in accordance with Division 01.

1.8 QUALITY ASSURANCE

A. Applicator Qualifications: Approved by manufacturer for making modifications and repairs to existing warranted roofing prior to execution of this Contract.
   1. Minimum of 5 years documented experience in roofing repairs of this type of roof.
   2. Include list of completed projects having similar scope of work identified by name, location, date, reference name, and phone number.

B. Materials Removal Firm: Company specializing in performing the work of this Section with minimum 5 years documented experience.

C. Certifications:
   1. Submit manufacturer's certification stating materials ordered and supplied are compatible with existing roofing system and will not void existing warranty.
   2. Submit manufacturer's project registration form indicating that manufacturer has reviewed Project and will issue or extend existing warranty to cover repairs warranty upon successful completion of installation.
   3. Submit manufacturer's approval of applicator.
   4. Certify materials shipped to Project site meet roof manufacturer's published performance standards and requirements of this Specification.
   5. State that membrane manufacturer approves of insulation type and method of installation.

D. Regulatory Requirements: Comply with governing EPA notification regulations before beginning membrane roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.9 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately below roofing modification area. Conduct roof modifications so Owner's operations will not be disrupted. Provide Owner with not less than 2 weeks notice of activities that may affect Owner's operations.
   1. Coordinate work activities daily with Owner so Owner can place protective dust or water leakage covers over sensitive equipment or furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below the work area if desired.
   2. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below the affected area. Verify that occupants below the work area have been evacuated prior to proceeding with work over the impaired deck area.

B. Protect building where roofing is scheduled to be modified, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from modification operations.

C. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

D. Owner assumes no responsibility for condition of areas to be modified.
   1. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.

E. Handle and store roofing materials and place equipment in a manner to avoid significant or permanent damage to deck or structural supporting members.

F. Weather Limitations: Proceed with roofing modification work only when existing and forecasted weather conditions permit Work to proceed without water entering into existing roofing system or building.
   1. Emergency Equipment: Maintain on-site equipment necessary to apply emergency temporary edge seal in the event of sudden storms or inclement weather.
   2. Maintain continuous temporary protection prior to and during installation of new roofing system.

G. Hazardous Materials: It is not expected that hazardous materials such as asbestos-containing materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

1.10 SEQUENCING AND SCHEDULING

A. Schedule work to coincide with commencement of installation of new roofing system.

B. Remove only existing roofing materials that can be replaced with new materials the same day.

C. Coordinate the work with other affected mechanical and electrical work associated with roof penetrations.

1.11 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during roof modification work, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.
   1. Notify warrantor of existing roofing system on completion of roofing modifications, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

B. If roofing system manufacturer's warranty is no longer in effect on the existing roof system, upon completion of Work and prior to final payment, furnish written warranty signed by installer and Contractor stating that for 2 year period from date of Substantial Completion of Building repairs and maintenance will be made to maintain roofing and flashings in watertight condition.

PART 2 - PRODUCTS

2.1 INFILL AND PATCHING MATERIALS

A. Use infill and patching materials, including sheet and adhesive materials, flashings, roof surfacing, fasteners, adhesives, and accessories, matching existing membrane roofing system materials, unless otherwise indicated.

2.2 TEMPORARY ROOFING MATERIALS

A. Selection of materials and design of temporary roofing is responsibility of Contractor. Select only materials that are compatible with existing roofing system. For pipe penetrations, use flashing materials and techniques as recommended by NRCA, utilizing portals mounted to curbs.

B. Base Sheet: ASTM D 4601, Type II, non-perforated, asphalt-impregnated and -coated, glass-fiber sheet.

C. Glass-Fiber Felts: ASTM D 2178, Type IV, asphalt-impregnated, glass-fiber felt.

D. Asphalt Primer: ASTM D 41.

E. Roofing Asphalt: ASTM D 312, Type III or IV.

2.3 AUXILIARY MATERIALS

A. General: Auxiliary preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing membrane roofing system

B. Insulation: Type used in original roof construction in thickness necessary to achieve satisfactory repair of membrane with no ponded water.

C. Wood Blocking and Nailers: As specified in Division 06.

D. Metal Flashing Sheet: Metal flashing sheet is specified in Division 07 Section "Sheet Metal Flashing and Trim."

E. Mechanical Fasteners and Disks: Appropriate for purpose intended and approved by UL or FM; length required for thickness of materials, fluoropolymer finish complete with disks; manufacturer as required by membrane manufacturer.

F. Ballast (if required): Type required to match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which roofing modifications will be performed with Installer present for compliance with requirements.

B. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.

C. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at roof penetrations and terminations and match the thicknesses of insulation required.

D. Do not proceed with installation until unsatisfactory conditions have been corrected.

E. Do not apply roofing materials to damp, frozen, dirty, dusty or other surface conditions which are unacceptable to manufacturer or applicator.

3.2 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prepare roof surfaces as recommended by manufacturer of original installation.

C. Protect existing membrane roofing system that is indicated not to be modified.
1. Loosely lay 1 inch minimum thick, molded expanded polystyrene (MEPS) insulation over the roofing membrane in areas indicated. Loosely lay 15/32-inch plywood or OSB panels over MEPS. Extend MEPS past edges of plywood or OSB panels a minimum of 1 inch.
2. Limit traffic and material storage to areas of existing roofing membrane that have been protected.
3. Maintain temporary protection and leave in place until replacement roofing has been completed.

D. Coordinate with Owner to shut down air intake equipment in the vicinity of the Work. Cover air intake louvers before proceeding with roof modification work that could affect indoor air quality or activate smoke detectors in the ductwork.

E. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

F. Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designed for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is forecast.
1. If roof drains will be temporarily blocked or unserviceable due to roofing system removal or partial installation of new membrane roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing membrane roofing system components that are to remain.

G. Verify that rooftop utilities and service piping have been shut off before commencing Work.

3.3 PROTECTION

A. Protect existing building surfaces against damage from roofing installation.

B. Provide temporary seals to prevent water from entering completed sections of the roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.4 PARTIAL ROOF REMOVAL

A. Partial Roof Tear-Off: Where indicated, remove existing roofing membrane and other membrane roofing system components down to the deck and as required to allow for proper patching of existing roof, and tie-in to new roofing system.
1. Remove cover boards, roof insulation, and substrate boards.
2. Bitumen and felts that are firmly bonded to concrete decks are permitted to remain if felts are dry. Remove unadhered bitumen and felts and wet felts.

3. Remove excess asphalt from steel deck. A maximum of 15 lb/100 sq. ft. of asphalt is permitted to remain on steel decks.
4. Remove fasteners from deck or cut fasteners off slightly above deck surface.

3.5 DECK PREPARATION

A. Inspect deck after partial tear-off of membrane roofing system.

B. Concrete Decks:
1. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.
2. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 or by pouring 1 pint of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if moisture condenses under the plastic sheet or if asphalt test sample foams or can be easily and cleanly stripped after cooling.
3. Do not proceed with installation until after the minimum concrete curing period, and moisture and pH levels are within the acceptable range as recommended by roofing system manufacturer.

C. Steel Decks: Verify infill deck is properly supported and secured, and that surface plane flatness and fastening of steel roof deck comply with requirements in Division 05 Section "Steel Decking."
1. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.
2. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect. Do not proceed with installation until directed by Architect.

D. If deck surface is not suitable for receiving new roofing, or if structural integrity of deck is suspect, immediately notify Architect. Do not proceed with installation until directed by Architect.

3.6 INFILL MATERIALS INSTALLATION

A. Immediately after removal of selected portions of existing membrane roofing system, and inspection and repair, if needed, of deck, fill in the tear-off areas to match existing membrane roofing system construction.
1. Install new roofing membrane patch over roof infill area. If new roofing membrane is installed the same day tear-off is made, roofing membrane patch is not required.

3.7 FLASHING AND REPAIR WORK

A. General: Perform work in accordance with instructions and recommendations of manufacturer of original installation materials.

B. Remove loose aggregate from aggregate-surfaced, built-up bituminous roofing with a power broom.

C. Clean substrate of contaminants such as dirt, debris, oil, and grease that can affect adhesion of roof patching materials.

D. Cut holes for penetrations neatly and in accordance with Division 01 Section "Cutting and Patching."

E. Where continuity of existing fastener pattern has been interrupted by cutting and patching work, provide additional uplift securement for existing roofing system with new screws and plates applied to each roof zone to comply with same wind uplift requirements as specified for new roofing work.

F. Lay base flashing and seal down to membrane and penetration.

G. Strip in flashing with multiple layers of felt and bitumen on built up systems and with one layer of sheet material on single ply systems.

H. Counterflash as required.

I. Make watertight.

J. Do not damage metal counterflashings that are to remain. Replace metal counterflashings damaged during removal with counterflashings of same metal, weight or thickness, and finish.

3.8 FIELD QUALITY CONTROL

A. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
1. Notify Architect and Owner 48 hours in advance of the date and time of inspection.

B. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

3.9 DISPOSAL

A. Collect and place demolished materials in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
   1. Storage or sale of demolished items or materials on-site will not be permitted.

B. Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

SECTION 07 72 00

ROOF ACCESSORIES

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. Roof curbs.
  2. Equipment supports.
  3. Roof hatches.
  4. Pipe supports.

1.3 PERFORMANCE REQUIREMENTS
- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.4 ACTION SUBMITTALS
- A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.
- B. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between shop-assembled and field-assembled work.

1.5 COORDINATION
- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and non-corrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.6 WARRANTY
- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
  1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
     a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
     b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
     c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 METAL MATERIALS
- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation and mill phosphatized for field painting where indicated.
  1. Mill-Phosphatized Finish: Manufacturer's standard for field painting.
  2. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- B. Galvanized-Steel Tube: ASTM A 500, round tube, hot-dip galvanized according to ASTM A 123/A 123M.

2.2 MISCELLANEOUS MATERIALS
- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Glass-Fiber Board Insulation: ASTM C 726, thickness as indicated.
- C. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.
- D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Underlayment:
  1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, non-perforated.

2. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
3. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

F. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

G. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

H. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

I. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

J. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 ROOF CURBS

A. Roof Curbs: Internally reinforced roof-curb units with integral spring-type vibration isolators and capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Curbs Plus, Inc.
b. LM Curbs.
c. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
d. Pate Company (The).
e. Thybar Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: steel sheet, 0.052 inch thick.
1. Finish: Mill phosphatized.

D. Construction:
1. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
2. Liner: Same material as curb, of manufacturer's standard thickness and finish.
3. Factory-installed wood nailer at top of curb, continuous around curb perimeter.
4. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.
5. Top Surface: Level around perimeter with roof slope accommodated by sloping the deck-mounting flange.

2.4 EQUIPMENT SUPPORTS

A. Equipment Supports: Internally reinforced metal equipment supports capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings; with welded or mechanically fastened and sealed corner joints, integral metal cant and integrally formed deck-mounting flange at perimeter bottom.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Curbs Plus, Inc.
b. LM Curbs.
c. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
d. Pate Company (The).
e. Thybar Corporation.

B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Material: steel sheet, 0.052 inch thick.
1. Finish: Mill phosphatized.

D. Construction:
1. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
2. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
3. Factory-installed continuous wood nailers 3-1/2 inches wide at tops of equipment supports.
4. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
5. Fabricate equipment supports to minimum height of 12 inches unless otherwise indicated.

6. Security Grille: Provide where indicated.

2.5 ROOF HATCH

A. Roof Hatches: Metal roof-hatch units with lids and insulated single -walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, integral metal cant, and integrally formed deck-mounting flange at perimeter bottom.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Babcock-Davis.
      b. Bilco Company (The).
      c. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
      d. Nystrom.
      e. O'Keeffe's Inc.

B. Type and Size: Single-leaf lid, refer to Drawings for size.

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Zinc-coated (galvanized) steel sheet, 0.079 inch thick.
   1. Finish: Mill phosphatized.

E. Construction:
   1. Insulation: Glass-fiber board.
   2. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   3. On ribbed or fluted metal roofs, form flange at perimeter bottom to conform to roof profile.
   4. Fabricate curbs to minimum height of 12 inches unless otherwise indicated.

F. Hardware: Stainless-steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

G. Safety Railing System: Roof-hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
   1. Height: 42 inches above finished roof deck.
   2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
   3. Flat Bar: Galvanized steel, 2 inches high by 3/8 inch thick.
   4. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
   5. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system. Provide manufacturer's standard hinges and self-latching mechanism.
   6. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
   7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
   8. Fabricate joints exposed to weather to be watertight.
   9. Fasteners: Manufacturer's standard, finished to match railing system.
   10. Finish: Manufacturer's standard.
      a. Color: As selected by Architect from manufacturer's full range.

H. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
   1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
   2. Height: 42 inches above finished roof deck.
   3. Material: Steel tube.
   4. Post: 1-5/8-inch- diameter pipe.
   5. Finish: Manufacturer's standard baked enamel or powder coat.
      a. Color: As selected by Architect from manufacturer's full range.

2.6 PIPE SUPPORTS

A. Pipe Supports: Adjustable-height, extruded-aluminum tube, filled with urethane insulation; 2 inches in diameter; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, and extruded-aluminum carrier assemblies; suitable for quantity of pipe runs and sizes.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Thaler Metal USA Inc.
   2. Pipe Support Height: As indicated on Drawings.
   3. Roller Assembly: With stainless-steel roller, sized for supported pipes.
   4. Pipe Support Flashing: Manufacturer's standard insulated sleeve flashing with integral base flange; aluminum sheet, 0.063 inch thick.
   5. Finish: Manufacturer's standard.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
C. Verify dimensions of roof openings for roof accessories.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.
   1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
   2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
   3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
   4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene sheet.
   2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
C. Roof Curb Installation: Install each roof curb so top surface is level.
D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
E. Roof-Hatch Installation:
   1. Install roof hatch so top surface of hatch curb is level.
   2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
   3. Attach safety railing system to roof-hatch curb.
   4. Attach ladder-assist post according to manufacturer's written instructions.
F. Pipe Support Installation: Install pipe supports so top surfaces are in contact with and provide equally distributed support along length of supported item.
G. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780.
B. Touch up factory-primed surfaces with compatible primer ready for field painting according to provisions of Painting Section.
C. Clean exposed surfaces according to manufacturer's written instructions.
D. Clean off excess sealants.
E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

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.
- B. Related work in other sections:
  1. Section 09 29 00 “Gypsum Board” for acoustical joint sealants.

1.2 SUMMARY
- A. Section Includes:
  1. Non-staining silicone joint sealants.
  2. Urethane joint sealants.
  3. Mildew-resistant joint sealants.
  4. Butyl joint sealants.
  5. Latex joint sealants.

1.3 ACTION SUBMITTALS
- A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.
- B. Product Data: For each joint-sealant product.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Joint-Sealant Schedule: Include the following information:
  1. Joint-sealant application, joint location, and designation.
  2. Joint-sealant manufacturer and product name.
  3. Joint-sealant formulation.
  4. Joint-sealant color.
- D. Sustainable Documentation Submittals:
  1. Recycled Content:
     a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
     b. Include statement indicating costs for each product having recycled content.
  2. Regional Material:
     a. Product data for regional materials (within 500 miles of construction site) indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.
     b. Include statement indicating cost for each regional material and the fraction by weight that is considered regional. For metal products, provide statement from manufacturer indicating location for scrap collection and other recycled materials include in the product and its distance from the project site.
  3. VOC content data. Provide for any adhesives, sealants, paints, or coatings used on the interior of the building.
     c. Product information or statement from manufacturer indicating the VOC content of the product in grams per liter (g/L).

1.4 INFORMATIONAL SUBMITTALS
- A. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer
- B. Pre-construction Laboratory Test Reports: From sealant manufacturer, indicating the following:
  1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
  2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.
- C. Pre-construction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- D. Field-Adhesion-Test Reports: For each sealant application tested.

1.5 QUALITY ASSURANCE
- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
  1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing

indicated.

C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 PRE-CONSTRUCTION TESTING

1. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants. Adhesion Testing: Use ASTM C 794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C 1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C 1248 to determine stain potential of sealant when in contact with stone substrates.
4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
   a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
      1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.7 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Refer to Section 01 31 00 – "PROJECT MANAGEMENT AND COORDINATION", for conference procedures.

1.8 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: 10 years from date of Substantial Completion.
      a. Silicone Sealants: 20 years from date of Substantial Completion.
      b. Urethane Sealants: 10 years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS (S-GP)

A. Non-staining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

B. Silicone, Non-staining, S, NS, 50, NT: Non-staining, single-component, non-sag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Dow Corning Corporation; 795.
b. GE Construction Sealants; SilPruf NB.
c. Pecora Corporation; 864NST.
d. Tremco Incorporated; Spectrem 2.
e. Sika Corporation; Silasil WS295.

2.3 URETHANE JOINT SEALANTS (U)

A. Urethane, S, NS, 25, NT: Single-component, non-sag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Construction Chemicals, LLC, Building Systems; Sonalastic TX1.
b. Pecora Corporation; Dynatrol I-XL.
c. Sherwin-Williams Company (The); Stampede-1.
d. Tremco Incorporated; Dymonic.
e. Sika Corporation; Sikaflex 2c NS.

B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
1. Products: Subject to compliance with requirements, provide one of the following:
a. BASF Construction Chemicals, LLC, Building Systems; Sonolastic SL 1.
b. Pecora Corporation; NR-201.
c. Sherwin-Williams Company (The); Stampede 1SL.
d. Sika Corporation; Sikaflex 2c SL.

C. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Bostik, Inc.; Chem-Calk 555-SL.
b. Pecora Corporation; Dynatrol II SG
c. Sherwin-Williams Company (The); Stampede-2SL.
d. Tremco Incorporated; THC 900/901.
e. Sika Corporation; Sika Sikaflex 2C SL.

2.4 MILDEW-RESISTANT JOINT SEALANTS (SS)

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Dow Corning Corporation; 786-M White.
   b. GE Construction Sealants; SCS1700 Sanitary.
   c. Tremco Incorporated; Tremsil 200.
   d. Sika Corporation; Sikasil GP.

2.5 BUTYL JOINT SEALANTS (BRJ)

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Bostik, Inc.; Chem-Calk 300.
   b. Pecora Corporation; BC-158.

2.6 LATEX JOINT SEALANTS (AL)

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. BASF Construction Chemicals, LLC, Building Systems; Sonolac.
   b. Pecora Corporation; AC-20.
   c. Sherwin-Williams Company (The); 850A.
   d. Tremco Incorporated; Tremflex 834.

2.7 PREFORMED JOINT SEALANTS (PF)

A. Preformed Foam Joint Sealant: Manufacturer's standard preformed, pre-compressed, open-cell foam sealant manufactured from urethane foam with minimum density of 10 lb/cu. ft. and impregnated with a nondrying, water-repellent agent. Factory produce in pre-compressed sizes in roll or stick form to fit joint widths indicated; coated on one side with a pressure-sensitive adhesive and covered with protective wrapping.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
   b. Sandell Manufacturing Co., Inc.; Polyseal.
   c. Willseal USA, LLC; Willseal 150.
   d. MM Systems, Color Joint Silicone
   e. BASF, WABO Weather Seal II

2.8 ACOUSTICAL JOINT SEALANTS (AC)

A. Acoustical Joint Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Pecora Corporation; AC-20 FTR.
   b. USG Corporation; SHEETROCK Acoustical Sealant.

B. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.9 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. BASF Construction Chemicals, LLC, Building Systems.
   b. Construction Foam Products, a division of Nomaco, Inc.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) , and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent

to joints.

D. Weep Tubes to Weep Space Between Inner and Outer Seals on Precast Panels: Weep and Vent Tubes: Clear plastic (PVC) UV-stable reticulated tubing, minimum 1/4-inch inside diameter, and of length as required to extend between exterior face of sealant and open cavity behind. At window and curtain wall systems, where required by system designer, provide gutter termination of tube with preformed nipples suitable for sealing to gutter.

E. Sound Attenuation Blankets: As specified in Section 09 29 00 "Gypsum Board."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:
   1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
   2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch. Hold edge of sealant bead 1/4 inch inside masking tape.
   3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
   4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

H. At dual joint installations, construction sequencing must allow for complete curing of interior bead of sealant prior to application of outer bead of sealant.

I. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
   1. Extent of Testing: Test completed and cured sealant joints as follows:
      a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
      b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
   2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
      a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   3. Inspect tested joints and report on the following:
      a. Whether sealants filled joint cavities and are free of voids.
      b. Whether sealant dimensions and configurations comply with specified requirements.
      c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
   4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
   5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces; (U) Urethane Joint Sealant.

1. Joint Locations:
    a. Isolation and contraction joints in cast-in-place concrete slabs.
    b. Joints between different materials listed above.
    c. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, M, P, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Exterior joints in vertical surfaces; (S-GP) Silicone Joint Sealant, or (PF) Preformed foam joint sealant. and horizontal nontraffic surfaces; (U) Urethane Joint Sealant.
1. Joint Locations:
    a. Construction joints in cast-in-place concrete.
    b. Joints between plant-precast architectural concrete units.
    c. Control and expansion joints in unit masonry.
    d. Joints in dimension stone cladding.
    e. Joints in exterior insulation and finish systems.
    f. Joints between different materials listed above.
    g. Perimeter joints between materials listed above and frames of doors, windows and louvers.
    h. Other joints as indicated on Drawings.
2. Joint Sealant: Silicone, non-staining, S, NS, 25, NT, and Urethane, M, P, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Double Joint-Sealant Application: Exterior joints in vertical surfaces; (S-GP) Silicone Joint Sealant.
1. Joint Locations:
    a. Bordered on both sides by porous building material (concrete, stone, masonry, precast concrete: Double application of backer rod and designation S-GP.
        1) Bordered on both sides by non-porous building material (coated and uncoated metals, anodized aluminum, porcelain tile, and glass): Designation S-GP
    b. Bordered on one side by porous building material (concrete, stone, masonry, precast concrete) and other side by non-porous building material (coated and uncoated metals, anodized aluminum, porcelain tile, and glass): Double application of backer rod and designation S-GP.
    c. Perimeter of penetrations through walls: Double application of backer rod and designation S-GP.

D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces; (U) Urethane Joint Sealant.
1. Joint Locations:
    a. Isolation joints in cast-in-place concrete slabs.
    b. Control and expansion joints in stone flooring.
    c. Control and expansion joints in tile flooring.
    d. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, S, P, 25, T, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces; (U) Urethane Joint Sealant.
1. Joint Locations:
    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Tile control and expansion joints.
    c. Vertical joints on exposed surfaces of unit masonry, walls and partitions.
    d. Other joints as indicated on Drawings.
2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement; (AL) Acrylic Latex.
1. Joint Locations
    a. Control joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints between interior wall surfaces and frames of interior doors, windows
    c. Other joints as indicated on Drawings.
2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces; (SS) Mildew Resistant Joint Sealants.
1. Joint Locations:
    a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    b. Tile control and expansion joints where indicated.
    c. Other joints as indicated on Drawings.
2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

H. Joint-Sealant Application: Concealed mastics; (BRJ) Butyl Rubber Joint.
   1. Joint Locations:
      a. Aluminum thresholds.
      b. Sill plates.
      c. Other joints as indicated on Drawings.
   2. Joint Sealant: Butyl-rubber based.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

I. Joint Sealant Application - STC-Rated Assemblies; Acoustical Joint Sealant (AC)
   1. Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
   2. Joint Sealant: Latex Sealant.
   3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION

SECTION 09 22 16

NON-STRUCTURAL METAL 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. Delegated Design requirements.
2. Non-load-bearing steel framing systems for interior gypsum board assemblies,
3. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.3 ACTION SUBMITTALS

A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.

B. Product Data: For each type of product indicated.

C. Delegated-Design Submittal: For design of non-structural metal wall framing indicated to comply with performance requirements and design criteria indicated, or required by adopted Building Code for the Project, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. For installed products and components indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation, licensed to practice in the project location.
2. Shop Drawings sealed by the qualified professional engineer responsible for their preparation, licensed to practice in the project location.

D. Shop Drawings: Include plans indicating locations of fire-rated partitions and assemblies, smoke partitions, acoustic rated partitions, insulated partitions, control joints, recessed items, installation standards, Underwriters Laboratories designations, fire-stopping locations and attachments to other work.

1. Drawings shall be sealed by the qualified professional engineer responsible for their preparation, licensed to practice in the project location
2. Include details of fabrication and installation, including plans, elevations, sections, details of components and attachment to other work.
3. Include scaled, dimensioned drawings indicating locations of control joints.
4. Distinguish between shop-fabricated and field-assembled work.
5. For fire-resistive rated assemblies indicate applicable UL listing.
6. Gypsum Board Panel Schedule: Include detailed schedule indicating gypsum board products to be installed and their respective locations. Coordinate with Schedule on the Drawings. Use same designations for identification purposes.

1.4 INFORMATIONAL SUBMITTALS

A. Sustainable Documentation Submittals:

1. Recycled Content:

a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.

b. Include statement indicating costs for each product having recycled content.

2. Regional Material:

a. Product data for regional materials (within 500 miles of construction site) indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.

b. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

c. For metal products, provide statement from manufacturer indicating location for scrap collection and other recycled materials include in the product and its distance from the project site.

B. Certifications: Manufacturer's certification the non-structural metal framing materials and assemblies are approved for locations and uses indicated for the work.

C. Evaluation Reports: For firestop tracks, from ICC-ES.

D. Span and Deflection Design Criteria: Provide height to load deflection charts showing studs supplied conform to deflection limit scheduled and allowed per ASTM C754.

1. Mark on chart(s) showing major partitions scheduled conformance with criteria.

2. Submit manufacturer's certification of stud size, thickness, and spacing complying with performance requirements and selections made by architect are correct for application shown.

1.5 QUALITY ASSURANCE

A. Fire-Resistance Ratings: Provide materials and construction identical to those of assemblies with fire-resistance ratings determined according to ASTM E 119 by a testing and inspecting agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association or the Steel Stud Manufacturers Association.

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Section 01 31 00 "Project Management and Coordination." Review methods and procedures for installing work related to non-structural metal framing including, but not limited to, the following:

1. Fasteners proposed for anchoring steel framing to building structure.

2. Sprayed fire-resistive materials applied to structural framing.

3. Wiring devices in partition assemblies.

4. Doors and other items to be framed as a part of partition assemblies.

5. Items supported by non-structural metal framing.

6. Mechanical work enclosed partitions.

1.6 COORDINATION

A. Provide field measurements for as-built construction and interface with adjoining construction.

B. Coordinate placement of concealed internal wall reinforcement, such as backing plates, for items to be attached to metal support systems.

C. Coordinate installation of ceiling and soffit suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorage to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings.

D. Furnish concrete inserts, and other devices indicated, to other trades for installation well in advance of time needed for coordination with other construction.

1.7 DELIVERY AND STORAGE

A. Delivery: Protect materials from excessive moisture in shipment, storage, and handling.

B. Storage: Store off ground, either in a dry, ventilated, enclosed space or protected with suitable waterproof coverings.

C. Handling: Protect non-structural framing members from rusting and damage.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. Recycled Content: Provide products with an average recycled content so that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 20 percent.

B. VOC Limits: any adhesives, sealants, paints, or coatings shall meet the VOC limits indicated in Section 01 81 14.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design for non-structural metal framing, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design standards indicated.

B. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

D. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft. unless noted otherwise or required by finish system requirements.

E. Partitions constructed as part of enclosed exit stair shall be engineered as rigid to comply with design requirements for pressurized stairs.

F. Partitions exceeding manufacturer's standard design heights.

G. Partitions where deflection requirements due to stone cladding are indicated.

2.3 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

B. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:

a. Minimum Base-Metal Thickness: 0.0179-inch (25 gauge) unless indicated otherwise on Drawings or below.

1) Interior Metal Stud/Gypsum Board Assemblies, Typical Locations: Withstand lateral loading (air pressure) of 5 psf with deflection limit not more than L/240 of partition height.

2) Interior Metal Stud/Gypsum Board Assemblies at Atriums, Lobbies, Service Corridors, Exit Corridors, Elevator Lobbies, Vertical Shafts, and walls receiving plaster veneer: Withstand lateral loading (air pressure) of 7.5 psf with deflection limit not more than L/360 of partition height.

3) Interior Metal Stud/Gypsum Board Assemblies at Locations with Ceramic Tile or Other Hard Surface Finishes: Withstand typical lateral loading (air pressure) with deflection limit not more than L/360 of partition height, minimum 0.0296-inch (20 gauge) studs at 16 inches on center.

4) Where wall mounted equipment, woodwork, and casework items are indicated or elsewhere as shown on Drawings, provide minimum 16 gage studs.

5) At jambs of openings provide two (2) minimum 0.0296-inch (20 gauge) studs.

6) Ceilings: At ceilings using mold-mildew resistant gypsum framing to be 16 inches o.c. for 5/8 inches gypsum.

7) Refer to Division 5 for stud framing which is exposed to wind loads and for studs carrying heavy vertical loads (cement plaster, manufactured stone masonry, stone tile thicker than 3/4 inch, etc).

b. Where partition heights exceed stud manufacturer's recommended spans, provide one of the following:

1) Heavier stud gage.

2) Closer stud spacing.

3) Deeper stud size (space permitting); As approved by Architect.

4) Above ceiling bracing, anchored to structure above.

c. Depth: As indicated on Drawings.

C. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.

2) MBA Building Supplies;

3) Steel Network Inc. (The); VertiClip SLD Series.

D. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.

b. Metal-Lite, Inc.; The System.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: Same as adjacent stud gauge.

2. Provide 16 gauge minimum where wall-mounted equipment, handrails, woodwork and casework items are indicated or elsewhere as indicated on Drawings.

F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.

1. Depth: As indicated on Drawings.

2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0179-inch (25 gauge).

2. Depth: 7/8 inch minimum; 1 1/2 inch maximum 0.0296 inch (20 gauge).

H. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical.

2. Minimum Base-Metal Thickness: 0.179-inch (25 gauge).

I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 3/4 inch.

2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.

3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.

2.4 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

a. Type: Post-installed, expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16-inch in diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053-inch and minimum 1/2-inch- wide flanges.

1. Depth: 2-1/2 inches.

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch wide flanges, 3/4 inch deep.

2. Steel Studs and Runners: ASTM C 645.

a. Minimum Base-Metal Thickness: 0.0179-inch (25 gauge).

b. Depth: 1-5/8 inches.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base-Metal Thickness: 0.0179-inch (25 gauge).

4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical.

b. Minimum Base-Metal Thickness: 0.0179-inch (25 gauge).

G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.

b. Chicago Metallic Corporation; Drywall Grid System.

c. USG Corporation; Drywall Suspension System.

H. Framing Manufacturer’s standard compression struts and bracing for exterior ceilings and soffits subject to wind uplift.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

B. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

C. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8-inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.

2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.

2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.

3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.

4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.

2. Multilayer Application: 16 inches o.c. unless otherwise indicated.

3. Partitions with Security Mesh: 8 inches (203 mm) o.c., unless otherwise indicated or required to comply with span and deflection design criteria.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended

ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
3. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
5. Curved Partitions:
    a. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches o.c.
2. Carrying Channels (Main Runners): 48 inches o.c.
3. Furring Channels (Furring Members): 16 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.

5. Do not attach hangers to steel roof deck.

6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

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 gypsum board panels for partition and ceiling applications.

2. Tile backing panels.

B. Related Requirements:

1. Section 07 84 13 – Penetration Firestopping: Joint sealants adjoining fire-resistive rated partitions and smoke partitions. Identification Marking of fire walls, fire barriers, fire partitions, smoke partitions and smoke barriers, required to have protected openings or penetrations.

2. Section 09 21 16.23 – Gypsum Board Shaft Wall Assemblies.

1.3 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.4 ACTION SUBMITTALS

A. General: Submit the following in accordance with Section 01 33 00.

B. Product Data: For each type of product.

C. Shop Drawings: Indicating location of fire rated partitions, smoke partitions, sound rated partitions, insulated partitions, and proposed location of control joints.

1. Coordinate with Section 09 21 16 “Gypsum Board Shaft Wall Assemblies” and Section 09 22 16 “Non-structural Metal Framing”.

D. Samples: For the following products:

1. Gypsum Board Panels: 6-inch square with manufacturer’s pre-printed label indicating product properties.

2. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.5 INFORMATIONAL SUBMITTALS

A. Sustainable Submittals:

1. Recycled Content:

2. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.

a. Regional Material:

3. Product data for regional materials (within 500 miles of construction site) indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.

B. Include statement indicating cost for each regional material and the fraction by weight that is considered regional

1. Product data for adhesives used to laminate gypsum board panels to substrates, documentation

including printed statement of VOC content.

C. Manufacturer's Certificates: Written certification from the manufacturer that the materials and their application as noted in this Specification and on the Drawings is appropriate and approved for this project

D. Installer Certificates:

2. Submit evidence that Installer's existing company has minimum of 5 years continuous experience in application of specified materials. Submit list of at least five completed projects of similar scope and size, including:

a. Project name.

b. Owner's name.

c. Owner's Representative name, address, and telephone number.

d. Description of work.

e. Self-adhering sheet materials used.

f. Project supervisor.

g. Total cost of waterproofing work and total cost of project.

h. Completion date

1.6 QUALITY ASSURANCE

B. Mockups: Provide in accordance with Section 01 40 00 "Quality requirements".

1. Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

2. Install mockups for the following:

a. Each level of gypsum board finish indicated for use in exposed locations.

b. Each texture finish indicated.

3. Apply or install final decoration indicated, including painting and wall coverings, on exposed surfaces for review of mockups.

4. Simulate finished lighting conditions for review of mockups.

5. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Coordinate requirements of Section 09 2116.23 "Gypsum Board Shaft Wall Assemblies" and Section 09 22 16 "Non-Structural Metal Framing".

1.7 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

B. Distribute stacked panels evenly across floor areas to prevent overloading building floor structure.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.9 PRE-INSTALLATION CONFERENCE

A. Conduct conference at Project site to comply with requirements of Section 01 31 00 "Project Management and Coordination." Review methods and procedures for installing work related to gypsum board shaft-wall assemblies including, but not limited to, the following:

1. Sprayed fire-resistive materials applied to structural framing.
3. Elevator equipment, including hoistway doors, elevator call buttons, and elevator floor indicators.
4. Wiring devices in wall assemblies.
5. Doors and other items penetrating wall assemblies.
6. Mechanical work enclosed within wall assemblies.
7. Gypsum wall board finishing requirements.

PART 2 PRODUCTS

2.1 GYPSUM BOARD, GENERAL

A. Regional Materials: Gypsum panel products shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Gypsum.
2. CertainTeed Corp.
3. Georgia-Pacific Gypsum LLC.
4. National Gypsum Company.
5. Temple-Inland.
6. USG Corporation.

B. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8-inch.
2. Long Edges: Tapered.

C. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Thickness: 1/4-inch.
2. Long Edges: Tapered.

D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2-inch.
2. Long Edges: Tapered.

E. Sound-Absorbing Gypsum Board: ASTM C 1396/C 1396M. Manufactured with a viscoelastic layer between gypsum panels for enhanced sound damping qualities.

1. Thickness: 5/8-inch.
2. Core: Type X.
3. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
4. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
5. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 1 requirements.
6. Long Edges: Tapered.

F. Impact-Resistant Gypsum Board: ASTM C 1396/C 1396M gypsum board, tested according tos ASTM C 1629/C 1629M; (for use in Stairwells and Electrical Rooms as indicated on the Drawings).

1. Core: 5/8-inch, Type X.
2. Surface Abrasion: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
3. Indentation: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
4. Soft-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements.
5. Hard-Body Impact: ASTM C 1629/C 1629M, meets or exceeds Level 3 requirements according to test in Annex A1.
6. Long Edges: Tapered.
7. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.3 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C 1396; Manufactured to have increased fire-resistive capability.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. American Gypsum; Firebloc Type C.
   b. CertainTeed Corp.; ProRoc Type C.
   c. Georgia-Pacific Gypsum LLC; Fireguard C.
   d. National Gypsum Company; Gold Bond Fire-Shield C.
   e. Temple-Inland; Type TG-C.
   f. USG Corporation; Firecode C Core.
2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
3. Long Edges: Tapered.

B. Glass-Mat Interior Gypsum Board: ASTM C 1658/C 1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use and at “semi-wet” areas (i.e. Mechanical Rooms, Janitor Closets, and Penthouses as indicated on the Drawings).

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Georgia-Pacific Gypsum LLC; DensArmour Plus.
2. Core: 5/8-inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10.

2.4 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. CertainTeed Corp.; GlasRoc Tile Backer.
   b. Georgia-Pacific Gypsum LLC; DensShield Tile Backer.
2. Core: 5/8-inch, Type X.
3. Mold Resistance: ASTM D 3273, score of 10.

B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges for exterior tile applications or cement stucco.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. C-Cure; C-Cure Board 990.
   b. CertainTeed Corp.; FiberCement BackerBoard.
   c. James Hardie Building Products, Inc.; Hardiebacker 500.
   d. National Gypsum Company, PermaBase Cement Board.

e. USG Corporation; DUROCK Cement Board.

2. Thickness: 1/2 inch.

3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.

2. Shapes:

a. Cornerbead.

b. Bullnose bead.

c. LC-Bead: J-shaped; exposed long flange receives joint compound.

d. L-Bead: L-shaped; exposed long flange receives joint compound.

e. U-Bead: J-shaped; exposed short flange does not receive joint compound.

f. Expansion Joint and Control Joint.

g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized steel sheet, plastic, or rolled zinc.

2. Shapes:

a. Cornerbead.

b. LC-Bead: J-shaped; exposed long flange receives joint compound.

c. Expansion Joint and Control Joint: Unless otherwise indicated: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fry Reglet Corp.

b. Gordon, Inc.

c. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.

3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

2. Exterior Gypsum Soffit Board: Paper.

3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

4. Tile Backing Panels:

a. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

b. Cementitious Backer Units: As recommended by backer unit manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Pre-filling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.

   a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.

4. Finish Coat: For third coat, use drying-type, all-purpose compound.

5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

D. Sound Attenuation Blankets (SAB): ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly

2. Thickness: As required to fill stud cavity.

E. Acoustical Joint Sealant: Refer to Section 07 92 00 “Joint Sealants.”

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc., except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.

2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board panels applied to non-load-bearing partitions at structural abutments or surfaces where movement is anticipated. Provide 1/4-inch to 1/2-inch- wide spaces at these locations. Trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with firestopping at fire-resistive rated assemblies and with acoustical sealant at non-rated assemblies.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Vertical surfaces unless otherwise indicated.
2. Flexible Type: Apply in double layer at curved assemblies.
3. Ceiling Type: Ceiling surfaces.
4. Abuse-Resistant Type: As indicated on Drawings.
5. Moisture- and Mold-Resistant Type: As indicated on Drawings.
6. Type C: Where required for specific fire-resistance-rated assembly indicated.
7. Glass-Mat Interior Type: Behind all wall tile, except showers and tubs. Provide cementitious backer units at shower & tub locations.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multi-layer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.

2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated. Install with 1/4-inch gap where panels abut other construction or penetrations.

B. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and wet areas indicated to receive tile.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.

2. LC-Bead: Use at exposed panel edges.

3. L-Bead: Use where indicated.

4. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.

2. LC-Bead: Use at exposed panel edges.

E. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

2. Level 2: Panels that are substrate for tile

3. Level 3: Panel surfaces that are to receive textured finish.

4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

a. Primer and its application to surfaces are specified in other Division 09 Sections.

5. Level 5: Where indicated on Drawings and substrates scheduled to receive gloss or semi-gloss paint finishes. Apply skim coat of joint compound over entire surface to receive Level 5 finish.

a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 30 00

TILING

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. Ceramic, porcelain and stone tile.
2. Glazed wall tile.
3. Stone thresholds.
4. Waterproof membrane.
5. Crack isolation membrane.
6. Metal edge strips.

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs. Tile face size shall be rectified. Rectified tile is tile that has been mechanically finished on all sides to achieve uniformity and precision for consistent dimensions.

1.4 PERFORMANCE REQUIREMENTS

A. Provide slip-resistant walking surfaces where subject to pedestrian foot traffic.

1. Dynamic Coefficient of Friction (level interior tiles that will be walked on when wet) per ANSI A137.1: DCOF (Dynamic Coefficient of Friction) of • 0.42, DCOF, or better, per DCOF AcuTestSM method.

1.5 ACTION SUBMITTALS

A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.

B. Product Data: For each type of product.

C. Sustainable Documentation Submittals:

1. Recycled Content:

a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.

b. Include statement indicating costs for each product having recycled content.

2. Regional Material:

a. Product data for regional materials (within 500 miles of construction site) indicating location and distance from Project of material manufacturer and point of extraction, harvest, or

recovery for each raw material.

b. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

c. For metal products, provide statement from manufacturer indicating location for scrap collection and other recycled materials include in the product and its distance from the project site.

3. VOC content data. Provide for any adhesives, sealants, paints, or coatings used on the interior of the building.

a. Product information or statement from manufacturer indicating the VOC content of the product in grams per liter (g/L).

4. Product data for flooring compliant with FloorScore standard. An acceptable alternative to FloorScore certified flooring is the use of flooring that meets testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

D. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

E. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

F. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.

2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.

3. Full-size units of each type of trim and accessory for each color and finish required.

4. Stone thresholds in 6-inch lengths.

5. Metal edge strips in 6-inch lengths.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.

C. Product Certificates: For each type of product.

D. Product Test Reports: For tile-setting and -grouting products and certified porcelain tile.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 5 percent of amount installed for each type, composition, color, pattern, and size indicated.

2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

3. Confirm quantities of extra materials with Owner prior to ordering materials. Adjust as directed.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer is a five-star member of the National Tile Contractors Association.

2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.

3. Installer employs Ceramic Tile Education Foundation Certified Installers.

B. Mockups: Provide in accordance with Section 01 40 00 “Quality Requirements”.

1. Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

2. Build mockup of each type of floor tile installation.

3. Build mockup of each type of wall tile installation.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

1.10 PRE-INSTALLATION CONFERENCE

A. Pre-installation Conference: Conduct conference at Project site. Refer to Section 01 31 00 – “PROJECT MANAGEMENT AND COORDINATION”, for conference procedures.

B. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.12 WARRANTY

A. See Section 01 77 00 - “Closeout Submittals” for additional warranty requirements.

B. The General Contractor, the tile subcontractor, the tile manufacturer and the installation materials manufacturer shall provide an 18 month full-replacement warranty to cover any defect, breakage or failure.

C. The manufacturer of the installation system materials shall provide a minimum 15-year Warranty for full system replacement of any defective materials provided.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.

1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

2. Obtain waterproof membrane and crack suppressant membranes, except for sheet products, from manufacturer of setting and grouting materials.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Stone thresholds.

2. Waterproof membrane.

3. Crack isolation membrane.

4. Cementitious backer units.

5. Metal edge strips.

2.2 PRODUCTS, GENERAL

A. VOC Limits: any adhesives, sealants, paints, or coatings shall meet the VOC limits indicated in Section 01 81 14.

B. Required Certification: Hard surface flooring shall be FloorScore certified. An acceptable alternative to FloorScore certified flooring is the use of flooring that meets testing and product requirements of the California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda.

C. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

1. Provide tile complying with Standard grade requirements unless otherwise indicated.

D. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.

E. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

F. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

1. Where tile is indicated for installation on exteriors, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

G. Dynamic Coefficient of Friction (level interior tiles that will be walked on when wet) per ANSI A137.1: DCOF (Dynamic Coefficient of Friction) of • 0.42, DCOF, or better, per DCOF AcuTestSM method.

2.3 TILE PRODUCTS

A. Tile: As scheduled.

1. Floor Tile: Dynamic Coefficient of Friction: Not less than 0.42 per Performance Requirements.

2. Tile face size shall be rectified.

3. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:

a. External Corners for Thinset Mortar Installations: Surface bullnose, same size as adjoining flat tile.

b. Internal Corners: Field-butted square corners. For coved base and cap use angle pieces designed to fit with stretcher shapes.

2.4 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor

finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 10 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.

1. Description: Uniform, fine- to medium-grained white stone with gray veining.

2. Description: Match Architect's sample.

2.5 WATERPROOF MEMBRANE

A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Non-plasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Noble Company (The); Nobleseal TS.

2. Nominal Thickness: 0.040-inch.

C. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and continuous fabric reinforcement.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.

b. Laticrete International, Inc.; Laticrete 9235 Waterproof Membrane.

c. MAPEI Corporation: Mapelastic HPG with MAPEI Fiberglass Mesh.

2.6 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Chlorinated Polyethylene Sheet: Non-plasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Noble Company (The); Nobleseal CIS.

C. Fabric-Reinforced, Fluid-Applied Membrane: System consisting of liquid-latex rubber or elastomeric polymer and fabric reinforcement.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane.

b. Laticrete International, Inc.; Laticrete.

c. MAPEI Corporation; Mapelastic HPG with MAPEI Fiberglass Mesh.

2.7 SETTING MATERIALS

A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.

1. Cleavage Membrane: Asphalt felt, ASTM D 226/D 226M, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils thick.

2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches by 0.062-inch diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.

3. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.

B. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

a. Ardex Americas.

b. Custom Building Products.

c. Laticrete International, Inc.

d. MAPEI Corporation.

3. Provide pre-packaged, dry-mortar mix containing dry, re-dispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.

4. Provide pre-packaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.

5. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to the other requirements in ANSI A118.4.

2.8 GROUT MATERIALS

A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

B. Standard Cement Grout: ANSI A118.6.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Custom Building Products.

b. Laticrete International, Inc.

c. MAPEI Corporation.

C. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Custom Building Products.

b. Laticrete International, Inc.

c. MAPEI Corporation.

2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

2.9 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

2. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:

a. Schluter Systems L.P.

b. Substitutions subject to provisions of Section 01 25 00 “Substitution Procedures”.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Tile Sealer: Stain protection for natural stone specifically approved for materials and installations indicated by stone tile manufacturer.

E. Grout Sealer: Liquid-applied moisture and stain protection for existing or new Portland cement grout, specifically approved for materials and installations indicated by tile and grout manufacturers.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors installed with thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.

b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.

3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.

4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4-inch per foot toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If tile packaging is not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 WATERPROOFING INSTALLATION

A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.

B. Do not install waterproofing membrane until all floor preparation, including installation of leveling materials, is completed.

C. Provide full coverage combination waterproofing and crack isolation membrane under all floor tile for installations over slab-on-grade and elevated floor structures of restroom areas, unless noted otherwise.

D. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.4 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.

B. Do not install crack isolation membrane until all floor preparation, including installation of leveling materials, is completed.

C. Provide full coverage combination waterproofing and crack isolation membrane under all floor tile for installations over slab-on-grade floor structures unless noted otherwise.

D. Provide full coverage under all floor tile for installations over all floor structures elevated above grade.

E. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.5 TILE BACKING PANEL INSTALLATION

A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

B. Use latex-portland cement mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.6 TILE INSTALLATION

A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:

    a. Exterior tile floors.

    b. Tile floors in wet areas.

    c. Tile swimming pool decks.

    d. Tile floors consisting of tiles 8 by 8 inches or larger.

    e. Tile floors consisting of rib-backed tiles

    f. Large format tile: Any tile with a edge dimension 15-inches or greater.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns.

1. Perform cutting and drilling of tile without marring visible surfaces.

2. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints.

3. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.

2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.

3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths:

1. Unless otherwise indicated, install tile with the following joint widths:

a. Ceramic Mosaic Tile: 1/16-inch.

b. Quarry Tile: 3/8-inch.

c. Pressed Floor Tile: 3/8-inch.

d. Glazed Wall Tile: 1/16-inch.

e. Porcelain Tile: 3/32-inch to 1/8 inch.

2. Confirm joint widths with tile manufacturer recommendations and approved mock-up.

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thinset).

2. Do not extend waterproofing under thresholds set in latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on waterproofing with elastomeric sealant.

K. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

L. Tile Sealer: Apply tile sealer to stone tile floors according to manufacturer's written instructions. Once sealer has penetrated tile, remove excess sealer from tile faces by wiping with soft cloth

M. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer from tile faces by wiping with soft cloth.

3.7 ADJUSTING AND CLEANING

A. Upon completion of installation, remove surplus materials, rubbish, from tiled areas.

B. Remove and replace tile that is damaged or that does not match adjoining tile.

C. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.

D. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

1. Remove grout residue from tile as soon as possible.

2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation.

a. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned.

b. Protect metal surfaces and plumbing fixtures from effects of cleaning.

c. Flush surfaces with clean water before and after cleaning.

3.8 FIELD QUALITY CONTROL

A. Testing: Engage a qualified testing agency to perform the following field tests and inspections and prepare test reports:

1. Samples of material delivered to Project site shall be taken, identified, sealed, and certified in presence of Owner and Contractor.

2. Sample one 12-inch-square sample minimum of traffic-coating system for every 1,000 square feet , or portion thereof, of traffic-coating installed. Dry film thickness will be measured.

a. Dry film thickness is satisfactory if not less than minimum thickness specified by traffic-coating manufacture or this Section, whichever is greater.

b. If dry film thickness too thin, apply additional material at no cost to Owner, or perform other remedial action recommended by traffic-coating manufacturer or Architect/Engineer.

c. Patch and restore sample areas with traffic-coating system. Blend so as to not be perceptible.

3. Chain drag areas at conclusion of Work to locate de-bonded tile areas. Remove and replace de-bonded areas.

4. If test results show tiling materials do not comply with requirements, remove non-complying materials, prepare surfaces, and reinstall compliant tiling materials.

5. Provide in-situ testing for Dynamic Coefficient of Friction. Remove non-compliant tile & reinstall compliant tile at all non-compliant areas as required to comply with

"PERFORMANCE REQUIREMENTS" Article.

3.9 PROTECTION

A. Protect installed tile work with kraft paper or other heavy covering, as necessary, to provide protection during remainder of construction period to prevent staining, damage, and wear.

B. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

E. Repair all materials damaged prior to turnover of the Work to Owner at Substantial Completion.

F. Replace all Work or materials damaged beyond repair, in opinion of Architect, at no cost to Owner.

3.10 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:

1. Ceramic Tile Installation: TCNA F113; On-Ground Concrete: thinset mortar.

a. Thinset Mortar: Latex- portland cement mortar.

b. Grout: Epoxy grout.

2. Ceramic Tile Installation: TCNA F113A; Above-Ground Concrete: thinset mortar.

a. Thinset Mortar: Latex- portland cement mortar.

b. Grout: Epoxy grout.

3. Ceramic Tile Installation: On-Ground Concrete: TCNA F122; thinset mortar on waterproof membrane.

a. Thinset Mortar: Latex- portland cement mortar.

b. Grout: Epoxy grout.

4. Ceramic Tile Installation: Above-Ground Concrete: TCNA F122A; thinset mortar on waterproof membrane.

a. Thinset Mortar: Latex- portland cement mortar.

b. Grout: Epoxy grout.

5. Ceramic Tile Installation: TCNA F125-Full; thinset mortar on crack isolation membrane.

a. Thinset Mortar: Latex- portland cement mortar.

b. Grout: Epoxy grout.

B. Interior Wall Installations, Metal Studs or Furring:

1. Ceramic Tile Installation: TCNA W243; thinset mortar on gypsum board.

a. Thinset Mortar: Latex- portland cement mortar.

b. Grout: Epoxy grout.

2. Ceramic Tile Installation: TCNA W245 or TCNA W248; thinset mortar on glass-mat, water-resistant gypsum backer board.

a. Thinset Mortar: Latex- portland cement mortar.

b. Grout: Epoxy ground.

C. Movement Joints in Floor Installation:

1. Contraction / Control Joints: TCNA EJ171B

2. General Movement Joints: TCNA EJ171F

3. Perimeter Movement Joints: Locations: Per TCNA EJ171J. Joint Type: Per TCNA EJ171G or EJ171I

END OF SECTION

SECTION 09 51 13

ACOUSTICAL PANEL CEILINGS

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. This Section includes acoustical panels and exposed suspension systems for ceilings.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete at ceilings.

1.3 DEFINITIONS

A. AC: Articulation Class.

B. CAC: Ceiling Attenuation Class.

C. LR: Light Reflectance coefficient.

D. NRC: Noise Reduction Coefficient.

1.4 SUBMITTALS

A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.

B. Product Data: For each type of product indicated.

1. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

C. Shop Drawings: Provide in accordance with Section 01 40 00 “Quality requirements”.

1. Include plans, elevations, sections, details, and attachments to other work.

2. Provide properly dimensioned shop drawings showing ceiling layout. Include field dimensions.

3. Show all locations, markings, quantities, materials, sizes and shapes and indicate all methods of connecting, anchoring, fastening, bracing and attaching to work of other trades.

4. Identify method of attaching ceiling perimeter trim to surrounding construction.

5. Distinguish between shop-assembled and field -assembled work.

6. Minimum Drawing Scale: 1/4 inch = 1 foot.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension system members.

2. Method of attaching hangers to building structure.

a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

4. Minimum Drawing Scale: 1/4 inch = 1 foot.

E. Samples for Initial Selection: For components with factory-applied color and finishes.

F. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.

1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.

2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

G. Mock-up: Submit full-size production quality ceiling panel system. Mock-up shall include all required accessories for a complete installation, including suspension and trims.

1.5 INFORMATIONAL SUBMITTALS

A. Sustainable Submittals:

1. Product data for adhesives and sealants, including printed statement of VOC content.

B. Research/Evaluation Reports: For each acoustical panel ceiling and components.

C. Maintenance Data: For finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory, or an NVLAP-accredited laboratory, with the experience and capability to conduct the testing indicated. NVLAP-accredited laboratories must document accreditation, based on a "Certificate of Accreditation" and a "Scope of Accreditation" listing the test methods specified.

B. Source Limitations:

1. Acoustical Ceiling Panel: Obtain each type through one source from a single manufacturer.

2. Suspension System: Obtain each type through one source from a single manufacturer.

C. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system through one source from a single manufacturer.

D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:

1. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

a. Smoke-Developed Index: 450 or less.

1.7 MOCK-UP

A. Provide mock-up including each component being used on the project to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Provides mock-ups of typical systems as shown on Drawings.

2. Minimum area of 10’ x 10’. Mock-up shall include all required accessories for a complete installation, including suspension and trims. Incorporate lighting, fire sprinkler and fire alarm devices for review.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

B. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at Date of Substantial Completion.

C. Remove mock-ups not approved from project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected

against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

B. Field Measurements: Verify areas to receive ceiling by field measurements and indicate measurements on Shop Drawings.

C. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions of areas to receive ceiling.

D. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.10 COORDINATION

A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.11 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project Site. Refer to Section 01 31 00 – “PROJECT MANAGEMENT AND COORDINATION”, for conference procedures.

B. Review installation requirements and required preparation by other trades.

1.12 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.

2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

3. Hold-Down Clips: Equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.

1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.

B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.2 ACOUSTICAL PANELS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.

2. BPB USA.

3. Chicago Metallic Corporation.

4. USG Interiors, Inc.

B. Basis-of-Design Product: Refer to Finish Schedule.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Recycled Content: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 20 percent.

B. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

D. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.

a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 for Class SC 1 service condition.

2. 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 hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

2. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than 0.106-inch- diameter wire.

F. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees.

2.4 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.

2. BPB USA.

3. Chicago Metallic Corporation.

4. USG Interiors, Inc.

B. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation, with prefinished 15/16-inch- wide (unless otherwise indicated in Finish Selection Summary) metal caps on flanges.

1. Structural Classification: Intermediate -duty system.

2. End Condition of Cross Runners: Override (stepped) or butt-edge type.

3. Face Design: Flat, flush.

4. Cap material: Steel cold-rolled sheet.

5. Cap Finish: White, unless indicated otherwise.

2.5 METAL EDGE MOLDINGS AND TRIM

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.

2. BPB USA.

3. Chicago Metallic Corporation.

4. Fry Reglet Corporation.

5. Gordon, Inc.

6. USG Interiors, Inc.

B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.

2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.

3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

C. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements and the following:

1. Aluminum Alloy: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.

2. Finish designations prefixed by AA comply with system established by the Aluminum Association for designating aluminum finishes.

3. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

a. Organic Coating: Thermosetting, primer/topcoat system with a minimum dry film thickness of 0.8 to 1.2 mils.

2.6 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide one of the following:

1. Acoustical Sealant for Exposed and Concealed Joints:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.

b. USG Corporation; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, paintable, non-staining latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

C. Acoustical Sealant for Concealed Joints: Manufacturer's standard non-drying, non-hardening, non-skinning, non-staining, gun-able, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636. indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

8. Do not attach hangers to steel deck tabs.

9. Do not attach hangers to steel roof deck. Attach hangers to structural members.

10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.

11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

1. Arrange directionally patterned acoustical panels as follows:

a. As indicated on reflected ceiling plans.

b. Install panels with pattern running in one direction parallel.

c. Install panels in a basket-weave pattern.

2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.

5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.

8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members.

B. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

C. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 61 16

CONCRETE FLOOR SEALING

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. This Section includes:

1. Sealing of concrete floor areas not otherwise scheduled to receive finish floor covering.

2. Cleaning and sealing of existing concrete floors not scheduled to receive finish floor covering.

1.3 ACTION SUBMITTALS

A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.

B. Product Data: For each type of product indicated.

1. Include data to indicate chemical, solvent, and detergent resistance.

2. Include information for primer, sealants, accessories and other required components.

1.4 INFORMATION SUBMITTALS

A. Sustainable Documentation Submittals:

1. VOC content data. Provide for any adhesives, sealants, paints, or coatings used on the interior of the building.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fluid-applied floor sealer to include in maintenance manuals. Include the following:

1. Manufacturer’s instructions on maintenance renewal of applied treatments.

2. Protocols and product specifications for joint filing, crack repair and/or surface repair.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this Section with minimum 10 years documented experience.

B. Installer Qualifications: An installer (applicator) who is approved, trained, or certified by fluid-applied floor sealer manufacturer.

C. Source Limitations: Furnish products from one manufacturer for entire Project, unless otherwise acceptable to Architect.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manner to prevent damage to containers and bags.

B. Store materials in accordance with manufacturer's instructions in clean and dry location with temperature between 60 deg F and 90 deg F.

C. Keep products away from fire or open flame.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Comply with flooring manufacturer's written instructions for substrate temperature, ambient temperature, humidity, ventilation, and other conditions affecting flooring application.

1. Do not apply flooring until spaces are enclosed and weatherproof; wet work in spaces is complete and dry; and overhead work, including installing mechanical systems, lighting, and athletic equipment, is complete.

B. Conditioning Period: Begins not less than 7 days before flooring application, is continuous through application, and continues not less than 3 days after application.

1. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.

C. Ventilate area where flooring is being installed. Post and enforce no smoking and no open flame signs until flooring has cured.

D. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during floor sealer application.

E. Close spaces to traffic during floor sealer application and for not less than 24 hours after application unless manufacturer recommends a longer period.

1.9 SEQUENCING AND SCHEDULING

A. Sequence work under provisions of Division 01 Section “Construction Progress Documentation.”

1.10 WARRANTY

A. Prepare and submit in accordance with Sections 01 61 00 and 01 77 00.

B. Provide written warranty signed by manufacturer warranting work to be free from defective materials and workmanship and agreeing to replace components which fail within 2 years from date of Substantial Completion.

1. Failed materials and workmanship includes spalling, cracking, and delamination.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Dayton Superior Specialty Chemical Corp.

2. L & M Construction Chemicals, Inc.

3. Euclid Chemical.

2.2 CONCRETE FLOOR SEALER

A. VOC Limits: All adhesives, sealants, paints, or coatings shall meet the VOC limits indicated in Section 01 81 14.

B. Acrylic: Super Diamond Clear VOX.

2.3 ACCESSORIES

A. Joint Sealant Materials: Manufacturer's recommended sealant compatible with flooring system for type of service and joint condition indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer (Applicator) present, for conditions affecting performance of flooring including substrate moisture content.

B. Examine areas to receive flooring for:

1. Defects in substrate that may affect proper execution of flooring work.

2. Deviations beyond allowable tolerance for concrete slab work.

3. Surface curing agents or sealers that would inhibit bond.

4. Surface defects such as cracks that could transfer through to finished flooring surface if not corrected.

C. Do not begin flooring work until concrete has cured a minimum of 28 days.

D. Do not begin work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare Substrate: Tests concrete substrate for pH, contaminants, and moisture content in accordance with manufacturer's recommendations. Ensure concrete is within manufacturers recommended limits prior to installation.

B. Concrete Sub-floors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.

2. Repair cracks, divots and surface imperfections according to manufacturer's instructions.

3. Vacuum to remove dust and debris.

C. Protect walls, floor openings, equipment, electrical openings, door frames, and other obstructions during installation. Cover floor and wall areas at mixing stations.

3.3 APPLICATION

A. General: Mix and apply flooring components according to manufacturer's written instructions.

B. Apply a minimum of 2 coats in accordance with manufacturer's recommended coverage rates.

3.4 CURING

A. Cure flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process.

1. Indoor Air Quality Procedures: Ventilate in accordance with Division 01 Section "Environmental Project Procedures."

3.5 CLEANING AND PROTECTION

A. Clean as recommended by manufacturer. Do not use materials or methods which may damage surface or surrounding construction.

1. Cleaner, Maximum VOC Content: In accordance with applicable codes.

B. Remove temporary covering and clean flooring prior to final inspection. Use cleaning materials and procedures recommended by flooring manufacturer.

C. Protect finished work in accordance with Division 01 Section "Common Execution Requirements."

D. Do not permit traffic over finished flooring surfaces.

E. Protect flooring materials from damage and wear during construction operation.

END OF SECTION

SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Vinyl base.
   2. Rubber molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.

C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Provide amount indicated on Finish Schedule.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Coordinate mockups in this Section with mockups specified in other Sections.
   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.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL BASE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armstrong World Industries, Inc.
   2. Burke Mercer Flooring Products; a division of Burke Industries Inc.
   3. Flexco.
   4. Johnsonite; a Tarkett company.
   5. Roppe Corporation, USA.

6. VPI Corporation.

B. Basis-of-Design Product: Johnsonite; 4-inch cove base.

C. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
1. Group: I (solid, homogeneous).
2. Style and Location: As scheduled
   a. Style A, Straight: Provide in areas with carpet.
   b. Style B, Cove: Provide in areas with resilient floor coverings.

D. Minimum Thickness: 0.125 inch (3.2 mm).

E. Height: 4 inches (102 mm).

F. Lengths: Coils in manufacturer's standard length.

G. Outside Corners: Job formed.

H. Inside Corners: Job formed.

I. Colors and Patterns: As scheduled.

2.2 VINYL MOLDING ACCESSORY

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Armstrong World Industries, Inc.
2. Burke Mercer Flooring Products; a division of Burke Industries Inc.
3. Flexco.
4. Johnsonite; a Tarkett company.
5. Musson Rubber Co.
6. Roppe Corporation, USA.

B. Profile and Dimensions: As indicated.

C. Locations: Provide vinyl molding accessories in areas indicated.

D. Colors and Patterns: As scheduled.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.
1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
      a. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
      a. Miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:
   1. Remove adhesive and other blemishes from surfaces.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION

SECTION 09 67 23

RESINOUS FLOORING

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. Resinous flooring systems in areas scheduled or noted on the drawings.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
B. Samples for Initial Selection: For each type of exposed finish required.
C. Product Schedule: For resinous flooring.
D. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
E. Material Certificates: For each resinous flooring component, from manufacturer.
F. Material Test Reports: For each resinous flooring system.
G. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.

1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated including a minimum of 7 years' experience in the installation of commercial resinous flooring systems.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
C. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Apply full-thickness mockups on 100 S.F. of floor area selected by Architect.
2. Simulate finished lighting conditions for Architect's review of mockups.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-installation Conference: Conduct conference at Project site. Refer to Section 01 31 00 – "PROJECT MANAGEMENT AND COORDINATION", for conference procedures.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application. Do not install tile until construction in spaces is complete and ambient temperature and humidity

conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Crossfield Products Corp.; Dex-O-Tex.
2. Key Resin Company.
3. Pacific Polymers, Inc.
4. Sherwin-Williams Company; General Polymers.
5. Stonhard®

B. Basis of Design: Stontec® by Stonhard®. Color as scheduled.

2.2 MATERIALS

A. VOC Content of Resinous Flooring: Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Resinous Flooring: 100 g/L.

2.3 DECORATIVE RESINOUS FLOORING

A. Resinous Flooring: Abrasion, impact and chemical-resistant, decorative-aggregate-filled, epoxy-resin-based, monolithic floor surfacing designed to produce a seamless floor.

B. System Characteristics:

1. Color and Pattern: As selected by Architect from manufacturer’s full range, without exceptions.
2. Wearing Surface: Textured for slip resistance. Provide slip-resistant walking surfaces where subject to pedestrian foot traffic

a. Dynamic Coefficient of Friction (level interior tiles that will be walked on when wet) per ANSI A137.1: DCOF (Dynamic Coefficient of Friction) of • 0.42, DCOF, or better, per DCOF AcuTestSM method.

3. Overall System Thickness: Manufacturer’s standard but not less than 3/16 inch4.8 mm.

C. Primer: Type as recommended by system manufacturer.

D. Body Coats:

1. Resin: Epoxy.
2. Formulation Description: 100 percent solids.
3. Application Method: Self-leveling slurry with broadcast aggregates.

a. Thickness and Number of Coats: As standard with manufacturer4.8 mm.

4. Aggregates: Colored quartz (ceramic-coated silica).

E. Topcoat: Sealing or finish coats.

1. Resin: Urethane.
2. Formulation Description: 100 percent solids.
3. Type: Clear.
4. Finish: Matte.
5. Number of Coats: One.

F. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Finish: satin: 15-25 units at 85 degrees; Gloss 90+ units at 60 degrees.
2. Flexibility: 180-degree bend, 1/8” mandrel per ASTM C 522.

3. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation per MIL-D-3134.
4. Abrasion Resistance: 150mg maximum weight loss per ASTM D 4060.
5. Flammability: Self-extinguishing per ASTM D 635.
6. Hardness: H, Shore D per ASTM D 3363
7. Impact Resistance: Direct 100 in.lb.; Indirect 80 in.lb. per ASTM D 2794.

2.4 ACCESSORIES

A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
    1. Roughen concrete substrates as follows:
        a. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.
    2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
    3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
        a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
        b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
        c. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.
D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
    1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum inter-coat adhesion.
    2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
    3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
B. Apply self-leveling slurry body coats in thickness indicated for flooring system.
    1. Broadcast aggregates at rate recommended by manufacturer and, after resin is cured, remove excess aggregates to provide surface texture indicated.

C. Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, remove trowel marks and roughness using method recommended by manufacturer.

D. Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat and to produce wearing surface indicated.

E. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Material Sampling: Owner may at any time and any number of times during resinous flooring application require material samples for testing for compliance with requirements.

1. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
2. If test results show applied materials do not comply with specified requirements, pay for testing, remove non-complying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.4 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Related Documents: General and Supplementary Conditions of the Contract, Division 01 General Requirements, and Drawings are applicable to this Section.

B. Section Includes:

1. Complete surface preparation and finishing for field application of coatings and requirements for field finishing mechanical and electrical equipment.

2. Examine specifications for various other trades and their provisions regarding their painting. Surfaces that are left unfinished by other sections of the specifications shall be painted or finished as a part of this Section.

3. Colors, including deep tones, will be selected by the Architect. Number of colors to be used on job will be determined by Architect.

C. Related Sections:

1. Section 09 96 00 – High-Performance Coatings.

2. Section09 96 63 – Elastomeric Coatings

1.2 SURFACES NOT TO RECEIVE FIELD FINISHING

A. Do not paint copper, bronze, chrome plated items, nickel, stainless steel, Monel metal, lead, face brick, prefinished wall, ceiling, and floor coverings, items with factory applied final finish (except where exposed on roofs and in finished spaces), elevator shafts, crawl spaces, chases, and plenums above suspended ceilings unless otherwise specified or scheduled.

1.3 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this Section

B. Interior Painting: Generally includes surfaces located in conditioned spaces.

C. Exterior Painting: Generally includes surfaces located in non-conditioned spaces.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable building code for flame spread/fuel contribution/smoke development rating requirements for finishes.

B. Comply with applicable city, county, state, and federal requirements and ordinances regarding maximum VOC (Volatile Organic Compound) content of all coatings.

1.5 ACTION SUBMITTALS

A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.

B. Product Data: Provide product data describing physical performance criteria and composition on all finishing products.

C. Samples: Submit 2 samples, 12-inches square in size illustrating range of colors and textures selected for each surface finishing product scheduled.

1.6 INFORMATIONAL SUBMITTALS

A. Sustainable Documentation Submittals:

1. Recycled Content:

a. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.

b. Include statement indicating costs for each product having recycled content.

2. Regional Material:

a. Product data for regional materials (within 500 miles of construction site) indicating location

and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material.

b. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

c. For metal products, provide statement from manufacturer indicating location for scrap collection and other recycled materials include in the product and its distance from the project site.

3. VOC content data. Provide for any adhesives, sealants, paints, or coatings used on the interior of the building.

a. Product information or statement from manufacturer indicating the VOC content of the product in grams per liter (g/L).

B. Submit certification from manufacturer of coatings listing all products proposed for each. Certify that each product meets current applicable regulations and ordinances regarding maximum VOC content.

1.7 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with 3 years' experience.

B. Applicator: Company specializing in commercial painting and finishing with 2 years' experience.

C. Product Labels: Include manufacturer's name, type of paint, stock number, color and label analysis on label of containers.

1.8 TESTS

A. Provide periodic testing with Wet Film Thickness gage to verify that proper thickness of finish coatings is being applied.

1.9 FIELD SAMPLES

A. Provide field sample panel, 96 inches long by 96 inches wide, illustrating each coating color, texture, and finish intended for use.

B. Locate where directed.

C. Accepted sample may remain as part of the Work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect products under provisions of Division 1 section "Product Requirements"

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptance.

C. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.

D. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer's instructions.

E. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the ranges required by paint manufacturer.

B. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 45 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

C. Do not apply exterior coatings during rain or snow, or when relative humidity is above 75 percent, unless required otherwise by manufacturer's instructions.

D. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Minimum Application Temperature for Varnish and Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid- height at substrate surface.

1.12 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Conduct conference at Project site. Refer to Section 01 31 00 – “PROJECT MANAGEMENT AND COORDINATION”, for conference procedures.

1.13 EXTRA STOCK

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gallon of each material and color applied

B. Label each container with color, color number, texture, and room locations, in addition to the manufacturer's label.

C. Furnish under provisions of Section 01 78 00.

1.14 SCAFFOLDS AND PROTECTION

A. Provide adequate safe ladders, scaffolds, and stages necessary to complete work.

B. Protect completed finish and paint work, and protect adjacent finish surfaces from paint splatter, spills and stains. Use adequate drop cloths and masking procedures during progress of work.

1.15 PRECAUTIONS

A. Do not store paints, oils, thinners and other flammable items inside the building and shall be stored in approved containers when not in actual use during the painting job. The fire hazard shall be kept at a minimum.

B. Precaution shall be taken to protect the public and construction workers during the progress of the work.

C. Furnish a temporary fire extinguisher of suitable chemicals and capacity, located near flammable materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements indicated, provide products of one of the following:

1. Sherwin-Williams.

2. P.P.G. Industries.

3. Benjamin Moore.

B. Materials selected for coating systems for each type surface shall be product of a single manufacturer unless otherwise specified. Secondary products such as linseed oil, turpentine and shellacs shall be first quality products of a reputable manufacturer.

C. Products specified in Schedule are those of Glidden Professional as a standard of quality unless otherwise noted.

2.2 MATERIALS

A. VOC Limits: any adhesives, sealants, paints, or coatings shall meet the VOC limits indicated in Section 01 81 13.

B. Coatings: Ready mixed. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating with good flow and brushing properties; capable of drying or curing free of streaks or sags.

C. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

D. Patching Materials: Latex filler.

2.3 FINISHES

A. Color and Sheen: As scheduled.

2.4 INTERIOR PAINT SCHEDULE

A. Drywall (Gypsum):

1. Acrylic Latex:

a. Sherwin-Williams: 1 coat ProMar 200 Zero VOC Interior Latex Primer B28W2600. Sherwin-Williams Flat: 2 coats Sherwin-Williams ProMar 200 Zero VOC topcoat.

B. CMU, Concrete Block:

1. Acrylic Latex:

a. Sherwin-Williams: 2 coats PrepRite Block Filler B25W25, 2 coats Sherwin-Williams ProMar 200 Zero VOC Semi-Gloss B31-2600 Series topcoat.

C. CMU, Concrete Block (Wet Areas):

1. High Performance Coating, Water-Based Epoxy:

a. Sherwin-Williams: 2 coats minimum Cement-Plex 875 B42W200/B42V201 primer for pin-hole free surface, 2 coats Sherwin-Williams: Pro Industrial Water Based Catalyzed Epoxy Gloss B73-300 Series.

D. Wood Paneling, Trim, Doors, Cabinets:

1. Acrylic Latex:

a. Sherwin-Williams: 1 coat, Premium Wall & Wood Primer B28W8111, 2 coats Sherwin-Williams ProMar 200 Zero VOC Semi-Gloss B31-2600 Series topcoat.

2. Polyurethane Varnish:

a. Sherwin-Williams: 1 coat Wood Classics Oil Stain A49-200 Series, 2 coats Sherwin-Williams Wood Classics Fast Dry Oil Varnish A66-300 Series.

E. Galvanized Metal:

1. High Performance Coating, Surface preparation SSPC SP-6 Commercial Metal Clast, 2-3 mil profile:

a. Sherwin-Williams: 1 coat Macropoxy 646-100 Epoxy @ 5-10 mils dry film thickness.

Sherwin-Williams: 2 coats Sher-Loxane 800 @ 4-6 mils dry film thickness.

2. Acrylic Latex

a. Sherwin-Williams: 1 coat Pro-Cryl Universal Primer B66-310 Series. Flat 2 coats Sherwin-Williams ProMar 200 Zero VOC Flat B30-2600 Series topcoat. Eg-Shel 2 coats Sherwin-Williams ProMar 200 Zero VOC Eg-Shel B20-2600 Series topcoat. Semi-Gloss 2 coats Sherwin-Williams ProMar 200 Zero VOC Semi-Gloss B31-2600 Series topcoat.

F. Shop Primed Ferrous Metal:

1. High Performance Coating, Water-Based Acrylic:

a. Sherwin-Williams: Touch up with Pro-Cryl Universal Primer B66-310 Serie
Sherwin-Williams: 2 coats Pro Industrial Acrylic Eg-Shel B66-660 Series.

or Sherwin-Williams: 2 coats Pro Industrial Acrylic Semi-Gloss B66-650 Series.

G. Handrails, Stairs, and Guardrails:

1. High Performance Coating, Urethane:

a. Sherwin-Williams: 1 coat Pro-Cryl Universal Primer B66-310 Series.

Sherwin-Williams: 2 coats Pro Industrial Water based Alkyd Urethane Semi-Gloss B53-1150 Series.

H. Machinery, Equipment and Fixtures (Shop Primed):

1. High Performance Coating, Water-Based Acrylic:

a. Sherwin-Williams: Touch up with Pro-Cryl Universal Primer B66-310 Series.
Sherwin-Williams: 2 coats Pro Industrial Acrylic Semi-Gloss B66-650 Series.

2.5 EXTERIOR PAINT SCHEDULE

A. Shop Primed Metal Doors, Trim, Panels and Miscellaneous Surfaces:

1. High Performance Coating, Urethane: (rust inhibitive, UV stable)

a. Sherwin-Williams: 1 coat Pro-Cryl Universal Primer B66-310 Series.

Sherwin-Williams: 2 coats Pro Industrial Water based Alkyd Urethane Semi-Gloss B53-1150 Series.

B. Poured, Precast or Tilt-up Concrete, Cement Plaster Stucco, Brick:

1. 100 Percent Acrylic Latex:

a. Sherwin-Williams: 1 coat Loxon Acrylic Concrete & Masonry Primer A24W8300, Flat: 2 coats Sherwin-Williams A-100 Flat A6-100 Series topcoat. Satin: 2 coats of Sherwin-Williams A-100 Satin A82-100 Series topcoat. Gloss: 2 coats of Sherwin-Williams A-100 Gloss A8 Series topcoat.

2. Elastomeric:

a. Sherwin-Williams: 1 coat Loxon Acrylic Concrete & Masonry Primer A24W8300, Smooth: 2 coats Sherwin-Williams ConFlex XL High Build Coating A5W451Smooth topcoat. Fine: 2 coats of Sherwin- Williams ConFlex XL Textured A5W800 topcoat: 2 coats of Medium A5W810 topcoat: 2 coats of Coarse A5W820 topcoat.

3. Textured Acrylic Coating: 100 Percent acrylic aggregate-filled coating; aggregate texture according to texture selection. Texture per approved mockup.

a. Sherwin-Williams: 1 coat Loxon Acrylic Concrete & Masonry Primer A24W8300; Smooth: 2 coats of Sherwin- Williams ConFlex UltraCrete Fine Textured CF17W0801topcoat; Medium: 2 coats of Sherwin- Williams ConFlex UltraCrete Medium CF17W0811 topcoat; Coarse: 2 coats of Sherwin- Williams ConFlex UltraCrete Extra Coarse CF17W0821 topcoat.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report to Architect any condition that may potentially affect proper application.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of the surface is below the following maximums

1. Plaster and Gypsum Wallboard: 12 percent.

2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3. Interior Located Wood: 15 percent, measured in accordance with ASTM D2016.

4. Exterior Located Wood: 15 percent, measured in accordance with ASTM D2016.

5. Concrete Floors: 8 percent.

D. Test shop applied primers for compatibility with subsequent cover materials.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

F. Beginning of installation means acceptance of existing surfaces and substrate.

3.2 PREPARATION

A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces or finishing.

B. Correct minor defects and clean surfaces which affect work of this Section. Remove existing coatings which exhibit loose surface defects.

C. Shellac and seal marks which may bleed through surface finishes.

D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

E. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high-pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

F. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

G. Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

H. Gypsum Board Surfaces: Latex fill minor defects. Spot prime defects after repair.

I. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

J. Concrete and Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.

K. Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

L. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

M. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

N. Aluminum with Alodine Finish: Clean by lightly scuff with sandpaper. Remove all dust.

O. Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.

P. Interior Wood Items Schedule to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

Q. Exterior Wood Scheduled to receive Paint Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied.

R. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.

S. Shop Finished Items: Finish in accordance with AWI standards and guide lines.

T. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

U. Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 SURFACE PREPARATION OF PREVIOUSLY COATED SURFACES

A. General:

1. Remove cracked and deteriorated sealants and calking.

2. Remove chalk deposits and loose, blistered, peeling, scaling, or crazed finish to bare base material or sound substrate by scraping and sanding.

3. Wash surfaces with solution of TSP to remove wax, oil, grease, and other foreign material; rinse, and allow to dry. Exercise caution that TSP solution does not soften existing coating.

4. Abrade glossy surfaces by sanding or wiping with liquid de-glosser.

5. Remove mildew as specified above.

6. Test compatibility of existing coatings by applying new coating to small, inconspicuous area. If new coatings lift or blister existing coatings, request recommendation from Architect.

7. Apply specified primer to surfaces scheduled to receive coatings.

B. Gypsum Wallboard:

1. Fill cracks and voids with spackling compound.

2. Apply primer over bare surfaces and newly applied texture coatings.

C. Metal:

1. Remove rust from surfaces to bare metal in accordance with SP3 "Power Tool Cleaning".

2. Exercise care not to remove galvanizing.

3. Complete preparation as specified for new work.

D. Wood:

1. Fill cracks, crevices and nail holes with putty or wood filler.

2. Apply primer over bare surfaces and filler material.

3.4 PROTECTION

A. Protect elements surrounding the work of this Section from damage or disfiguration.

B. Repair damage to other surfaces caused by work of this Section.

C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

D. Remove empty paint containers from site.

3.5 APPLICATION

A. The intent of these Specifications is to produce the highest quality appearance of paint and finish surfaces. Employ skilled mechanics only. The proper preparation of all surfaces will be strictly enforced and wherever finished surfaces show any defects due to improper preparation, workmanship, etc., the defects shall be removed, and the work refinished at the expense of the Contractor.

B. Apply products in accordance with manufacturer's instructions. Final finish coats shall have visual evidence of solid hiding and uniform appearance, and shall be free and smooth of brush marks, streaks, sags, runs, laps, or skipped areas.

C. Do not apply finishes to surfaces that are not dry.

D. Apply each coat to uniform finish and thickness.

E. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

F. Sand lightly between coats on wood and metal items to achieve required finish.

G. Allow applied coat to dry before next coat is applied.

H. Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

I. Prime back surfaces of interior and exterior woodwork scheduled to be painted with primer paint.

J. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

K. Edges of paint adjoining other materials or colors shall be sharp and clean with no overlapping.

3.6 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint all shop primed equipment. Paint shop prefinished items where exposed to view in finished spaces. In mechanical rooms, repair shop pre-finished coatings which have been scratched or otherwise damaged with identical touch-up paint. Sand prior to touching up as required.

B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

C. Paint all grilles, registers, diffusers, and speaker grilles to match adjacent wall and ceiling surfaces, except that factory pre-finished items need not be painted if installed in a suspended acoustical ceiling system where the acoustical panels match the mechanical or electrical item color.

D. In all finished spaces, prime and paint exposed pipes, conduit, boxes, ducts, hangers, brackets, collars and supports. Paint to match adjacent surfaces.

E. Repair or replace identification markings on mechanical or electrical equipment when painted accidentally.

F. Paint interior surfaces of air ducts and convectors that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed behind louvers, grilles, and convector to match face panels.

G. Paint all surfaces of plywood backboards for electrical and telephone equipment before installing equipment.

H. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.

I. Paint exposed air handlers, roof ventilators, goose necks, exhaust fans and other items on the roof with 2 coats exterior enamel. Prepare surfaces in accordance with the base metal or primer as specified herein.

J. Paint concrete support bases with gray floor deck enamel.

K. Pipe hangers and other supports need not be painted except where installed in crawl spaces, where they shall be painted with a thick coat of asphaltic paint.

3.7 CLEANING/TOUCH-UP

A. As Work proceeds, promptly remove paint where spilled, splashed, or spattered.

B. During progress of Work maintain premises free of unnecessary accumulation of tools, equipment, surplus materials, and debris.

C. Collect cotton waste, cloths, and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

D. Spot painting will be allowed to correct soiled or damaged paint surfaces only when touch-up spot will blend into surrounding finish and is invisible to normal viewing (as determined by the Architect). Otherwise, re-coat entire section to corners or to a visible stopping point.

END OF SECTION

SECTION 10 44 13

FIRE PROTECTION CABINETS

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. Fire-protection cabinets for the following:

a. Portable fire extinguishers.

1.3 ACTION SUBMITTALS

A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.

B. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semi-recessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

C. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches square.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with Authority Having Jurisdiction and indicated wall depth.

C. Coordinate locations and types of cabinets for compliance with Accessibility requirements (ADA, TAS).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Products: Subject to compliance with requirements, provide products by one of the following:

a. JL Industries, Inc.; a division of the Activar Construction Products Group.

b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.

c. Larsens Manufacturing Company.

d. Potter Roemer LLC.

B. Cabinet Construction: Non-rated in non-rated walls; 1or 2-hour fire rated in rated walls to match rating of wall.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch-thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.

C. Cabinet Material: Cold-rolled steel sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semi-recessed Cabinet (FEC-1): One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

1. Cabinet Material: Stainless steel.

a. Shelf: Same metal and finish as cabinet.

2. Rolled-Edge Trim: 2-1/2-inch backbend depth.

3. Cabinet Trim Material: Same material and finish as door.

4. Door Material: Stainless steel.

a. Door Style: Vertical duo panel with frame Vertical glass slot.

b. Door Glazing: Tempered float glass (clear).

5. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

a. Provide projecting lever handle with cam-action latch.

b. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

E. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel or powder coat.

b. Color: As selected by Architect from full range of industry colors and color densities.

2. Stainless Steel: ASTM A 666, Type 304.

a. Finish: No. 4 directional satin finish.

3. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

F. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.

2) Application Process: Silk-screened.

3) Lettering Color: Black.

4) Orientation: Vertical.

b. In addition to providing cabinet identification, provide triangular signage above each extinguisher identifying the device from both sides.

2.3 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.

2. Provide factory-drilled mounting holes.

3. Prepare doors and frames to receive locks.

4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.

2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for cabinets to verify actual locations of piping connections before cabinet installation.

B. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semi-recessed fire-protection cabinets.

2. Provide inside latch and lock for break-glass panels.

3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

4. Fire-Rated Cabinets:

a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.

b. Seal through penetrations with firestopping sealant as specified in Section 078413 "Penetration Firestopping."

3.4 SCHEDULE

A. Locations as indicated on the Drawings and as follows:

1. FEC-1: Building Interior

3.5 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 10 44 16

FIRE EXTINGUISHERS

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 portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.3 ACTION SUBMITTALS

A. Refer to Section 01 33 00 – “SUBMITTAL PROCEDURES”, for submittal procedures.

B. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

C. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

B. Coordinate capacities and locations of fire extinguishers with Authority Having Jurisdiction. Notify Architect of any changes in quantity of fire extinguishers.

1.7 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site. Refer to Section 01 31 00 – “PROJECT MANAGEMENT AND COORDINATION”, for conference procedures.

1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:

a. Schedules and coordination requirements.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.

b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Amerex Corporation.

2. Valves: Manufacturer's standard.

3. Handles and Levers: Manufacturer's standard.

4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type: UL-rated, 10 lb capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

C. Purple-K Dry-Chemical Type in Aluminum Container (in common use kitchens): UL-rated 10-B:C, 2.5-lb nominal capacity, with potassium bicarbonate-based dry chemical in enameled-aluminum container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amerex Corporation.

B. Identification:

1. Primary Identification: Provide bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals complying with requirements of authority having jurisdiction, applied to the mounting surface.

a. Orientation: Vertical.

2. Additional Identification: Provide identification on a surface mounted triangular device visible from both sides with lettering complying with requirements of authority having jurisdiction for letter style, size, spacing, and location.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

1. Mounting Brackets: Between 36-48 inches above finished floor to top of fire extinguisher.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION

SECTION 11 40 00

FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS:

Work of this Section shall conform to the requirements of the Contract Documents.

1.2 DESCRIPTION:

A. Work Included:

Food Service Equipment required for this work is indicated on the Drawings and includes, but is not necessarily limited to the following:

1. Furnish all labor, materials and services necessary to complete the work of this Section.

2. Supplying and setting in place all new food service equipment and appliances as shown on the drawings and listed in the "Food Service Equipment Schedule - NEW".

B. Related Work:

1. Electrical service and connection to Kitchen Equipment, overload protection requirements wiring between starters, when starters and controls are not integral with equipment. Electrical contractor shall make final connection of drain line heaters to terminal block on refrigeration coil.

2. Plumbing work and connections, including fittings which are not integral part of equipment, floor drains, water and waste lines to refrigeration compressors including their connections, and miscellaneous plumbing work, except as otherwise specified in this Section.

3. Heating, ventilating and air conditioning except as otherwise specified in this Section.

4. Concrete, masonry and miscellaneous metals, except as otherwise specified in this Section.

5. Stainless steel corner guards attached to building structure.

6. Dining tables, chairs, cash registers, cashiers' stools, pots, pans, dishes, glassware, trays, silverware will be provided by the Owner.

1.3 QUALITY ASSURANCE:

A. Manufacturers Instructions

In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for all phases of work.

B. Standards

1. Underwriters' Laboratories.

2. Published standards of the National Sanitation Foundation.

3. American Society of Mechanical Engineers

4. National Fire Protection Association Standards Pamphlet No. 96.

5. National Electrical Code.

6. All applicable National, State and Local Codes.

1.4 SUBMITTALS:

A. Shop Drawings

1. Shop drawings shall be submitted in accordance with requirements of the General Conditions. (Note: Reproduction or enlargement of contract drawings is not acceptable).

(a) Floor plans, showing detailed dimensions for utility lines and equipment to a scale of 1/4" equals 1'-0" minimum. These dimensions shall be taken from finished walls and columns and include all electrical and plumbing floor "stub-up", "out of wall" and "branch to connection (BTC)" notations for use in the field.

(b) Floor plans, showing detailed dimensions for elevated bases, floor depressions, wall openings, locations of partitions and wall reinforcing as related to equipment supplied under this Section, to a scale of 1/4" equals 1'-0" minimum.

(c) Dimensioned Equipment Construction Drawings, indicating reinforcement, anchorage and other work required for completion and installation of equipment under this Section to a scale of 3/4" equals 1'-0".

(d) One (1) print and one (1) reproducible of all shop drawings required shall be submitted for approval.

(e) Manufacturer's standard catalog cut sheets shall be submitted in a covered, bound booklet preceded by a corresponding cover sheet. Each cover sheet shall include the item number, model number, manufacturer's name, required utilities, and all options and accessories specified. Two (2) booklets shall be submitted for approval.

(f) Schedule of Equipment and Connections: A schedule similar to what is shown on Drawings including all remarks and general notes submitted as part of the mechanical rough-in, HVAC and base and depression drawings.

Typically, details for all custom fabricated equipment shall include fully detailed plan, elevation and section on views of all applicable specified Items.

B. Samples:

1. Applicable samples shall be submitted with shop drawings and shall be actual size of equipment consisting of, but not limited to the following:

(a) Leg assembly, with gusset, foot, and crossrail.

(b) Corner of table top.

(c) Drawer assembly.

(d) Section of hinged door.

(e) Corner of Serving Counter.

(f) Handles and hardware (hinges, catches, etc.).

(g) Corner of trayslide.

1.5 PRODUCT HANDLING:

A. Protection:

Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacement:

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

1.6 QUALIFICATION:

A. To be considered eligible to work on this project, the Contractor for the work of this Section of the Specifications must:

1. Be a fully recognized Food Service Equipment Contractor currently engaged in the installation of standard manufactured and custom fabricated commercial Food Service Equipment for a period of five (5) years prior to submitting bid.

2. Have successfully completed similar projects of the same Food Service Equipment dollar value and design scope within the last two (2) years.

1.7 PRIOR APPROVALS:

The prospective Contractor for the work of this Section of the Specifications shall submit all proposed alternate equipment manufacturers (substitutions) in writing to the Architect PRIOR to submitting their bid. This request shall be accompanied by the following information:

1. List of three similar installations having equipment being proposed for this project and date of completed installations.

2. Complete literature, performance and technical data describing the proposed equipment, as noted above in Section 1.04 e.

3. Location of close service office from which equipment will be maintained, if required.

4. Location of close parts inventory for this equipment, if applicable.

Prior written approval of the Architect is required for proposed alternate equipment. If no substitutions are submitted prior to bid date, it will be presumed by all parties concerned that none are being offered, and the bid is being submitted in full accordance with the Contract Documents.

NO ALTERNATE EQUIPMENT (SUBSTITUTIONS) WILL BE CONSIDERED AFTER CONTRACT HAS BEEN AWARDED.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Stainless steel, where specified, shall be Type 302, No. 4 finish.

B. Galvanized steel sheets shall conform to ASTM-A164, Type RS. Where galvanized steel has been welded, seams shall be thoroughly cleaned and finished with one coat of zinc-rich paint (70% zinc). Galvanized structural steel shall conform to ASTM-A123 and A-153. Hot dip galvanization shall conform to ASTM-A386.

C. Steel pipe shall be fully galvanized. All threads are to be cleaned and coated with rust-resistant coating.

D. Structural Shapes: All angles, band channels, etc., used for framing shall conform to ASTM-A36.

E. Fastenings: All bolts, screws, nuts, and washers shall be galvanized or cadmium-plated steel, except that where brass or stainless steel is fastened, the fastenings shall be brass or stainless steel respectively. Where dissimilar metals are fastened, bolts, screws, and nuts shall be made of an approved non-corrosive metal.

2.2 WORKMANSHIP:

A. Fasteners: Except as otherwise specified or approved by the Architect, exposed finished surfaces shall be free from bolts, screws, and rivet heads. Wherever threads of bolts and screws occur on the inside of fixtures and are either visible or might come in contact with hands or wiping cloths, such bolts and screws shall be capped with a suitable lockwasher and chrome plated brass or bronze acorn nut. Where screw threads are welded to the underside of trim and tops, their spacing and intent of rivets, bolts, and screws shall be such as to insure proper fastening and prevent bulging of the materials fastened.

B. Welding shall be done by the electric fusion metal arc method. Carbon arc and gas welding will not be permitted. Welds shall be continuous, strong, and ductile, with excess metal ground off joints finished smooth to match adjoining surfaces. All joints in tops of fixtures, tables, drainboards, overshelving, sinks and other equipment shall be welded. Butt welds made by spot welding straps under seams and filling in the voids with solder and finish by grinding, will not be acceptable. Tops of fixtures shall be fabricated in the factory with welded joints to reduce field joints to a minimum. Field joints shall be welded and exposed welds ground smooth and polished to match factory finish. Wherever material has been depressed by a welding operation, such depressions shall be suitably hammered and peened flush with the adjoining surface and, if necessary, be ground again to eliminate low spots. Care shall be exercised in all grinding operations to avoid excessive heating of the metal, causing discoloration. In all cases, the grain of rough grinding shall be removed by successive polishing operations. Wherever such break bends occur, they shall be free of undue extrudence and shall not be flaky, scaly, and cracked in appearance. Where such breaks mar the uniform surface appearance of the materials, all such marks shall be removed. Sheared edges shall be free from burrs, fins, and irregular projections, and shall be finished to obviate all danger of cutting and laceration when the hand is drawn over the edge. Mitres and bullnosed corners shall be welded.

C. Exposed stainless steel: All surfaces shall have a No. 4 finish as specified hereinbefore. An exposed surface shall be interpreted as meaning outside surfaces exposed to view and inside surfaces exposed to view when a sliding or swinging door is opened. The underside of a shelf may be a No. 80 ground finish. Final finish to be Contractor's factory finish and not as furnished by mill.

D. Underside of tops: All work tops, dishtables and drainboards shall be treated with an approved spray-on sound deadening material with an aluminum spray finish. Sound deadening shall be applied to fixtures after tops have been completely fabricated.

E. Soldering: Shall be done in strict accordance with recommended procedures of the stainless steel manufacturer. In no case shall soldering be relied upon for the stability of seams and joints. The soldering shall serve only as filler to prevent leakage. Soldering shall not at any time be used in and on any surfaces which may come in contact with foods. Soldering shall not at any time be considered as replacing welding or brazing.

F. Equipment: All equipment shall be mechanically fastened to walls, floors, or ceiling and assembled together.

G. Protective Coverings: All protective coverings shall be furnished and maintained for the protection of the equipment until ready for inspection and demonstration.

H. Field Conditions: Where mechanical or structural field conditions have direct cause to alter equipment specified in any manner, notify the Architect in writing for directional purposes before proceeding with that portion of the work.

I. Control Devices: All fittings, control valves, plumbing works, or electrical operating switches, furnished as part of the equipment shall match and equal in every respect those specified under the Mechanical and

Electrical Sections of the Specifications. Each piece of apparatus shall have, in addition to mainline control valves, individual operating valves, so that any piece of apparatus may be removed for repairs without interruption of the remaining apparatus.

All such valves, switches, and fittings shall be located at a point of greatest convenience for operation and shall be furnished by the Kitchen Equipment Contractor.

J. Appurtenances and Access Panels: Provide all appurtenances which may not be specifically mentioned in the specifications or shown on drawings but which are required for the proper functioning of the equipment. This shall also include plumbing fittings or electrical controls which are not normally furnished by the manufacturer for the proper equipment functioning. Provide proper access panels to service equipment within the units.

K. Starting Switches: Furnish starting switches including those for remote installation, to the Electrical Contractor, who shall install and wire same.

L. Pipes, fittings, and Valves: All pipes, fittings, and valves required within the equipment shall be furnished with respective items of equipment. Exposed plumbing, piping, fittings, valves, and conduit shall be chrome plated.

2.3 OTHER MATERIALS:

All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be provided by the Contractor and shall be new, first quality of their respective kinds, and subject to approval of the Engineer.

2.4 FABRICATED EQUIPMENT:

A. Sinks and Drainboards: All sinks and drainboards shall be constructed of 14 gauge stainless steel as follows:

1. Joints shall be welded. Front and ends, unless otherwise indicated on drawings, shall be extended 3", measured at sink edge, and rolled on a diameter of 1-1/2", 180°. Raised, rolled rim at front and ends of drainboard shall be leveled with sink rolled rim and continuous therewith and shall not follow the pitch of the drainboard. Drainboards shall be pitched 1/8" per 1'-0" towards sink compartments. Sinks and drainboards adjacent to walls or adjoining equipment, shall have 10" high splashbacks, level and continuous, not following the pitch of drainboards. Where drainboards are 24" or less, they shall be supported on one inch outside diameter by 16 gauge stainless steel tubular, seamless diagonally braces and secured to sink gussets, welded around entire perimeter. Where drainboards exceed 24" in length, legs shall be provided. All vertical and horizontal corners shall be rounded to a radius of approximately one inch, with intersections meeting in the spherical sections. All sinks having two or more compartments shall have double dividing partitions with fully rounded corners, both vertical and horizontal. All corners of rolled rim shall be fully rounded outside roll and be concentric with inside roll. The bottom of each sink compartment shall be creased to a sufficient pitch toward waste outlet. Openings for hot and cold faucets shall be cut into splashbacks as required. All sinks shall be 16" deep, unless otherwise specified or indicated on the drawings. All divider panels where required shall be a minimum of 3/4" thick double wall stainless steel construction.

2. Each sink compartment including bain-marie type sink compartments shall be provided with a waste outlet. Each waste outlet, except as otherwise specified, shall be a two inch twist-handle valve constructed of the best grade chrome plated cast brass or bronze. Model No. D50-4590, as manufactured by "Component Hardware", or an approved equal. The outlet shall be free-flowing, non-clogging type, with a perforated strainer of stainless steel on the interior of the sink bottom and having two inch pipe size thread at the lower end, and shall provide chrome plated locknut washers and chrome plated tailpiece. The outlet shall be precision machine tee-fitting protected by a sealed stuffing box which shall eliminate the possibility of leakage from key to exterior of outlet. The outlet shall be set into a die depression and attached without rivets to the sink bottom, and shall be furnished with externally operated stainless steel lever handles. The outer body shall have an opening threaded to receive 1-1/4" iron pipe size overflow at the rear. This overflow fitting shall be

1-1/4" brass chrome plated, and shall be provided with a stainless steel strainer on the sink interior and shall be connected to the waste outlet by means of 1-1/2" brass pipe tubing which shall be chrome plated, except as otherwise specified.

3. Sinks set into work counters or table tops shall be constructed of same gauge and materials as specified for counter top as follows:

   a. Top perimeter of each sink shall be integrally welded to edge of opening in table or counter top. Table or counter top shall be die-punched to receive faucets.

   b. Sinks shall have vertical and horizontal corners rounded on a 1" radius, with bottoms pitched to a 1-1/2" or 2" waste outlet, depending which is indicated on drawings. Sinks shall be finished the same as table or counter tops.

4. Water inlets shall be located in all instances above the positive water level to prevent syphoning of liquids into the water system.

5. Dishtables shall be constructed same as previously specified for sinks and drainboards unless otherwise indicated on drawings.

B. Stainless Steel Tabletops: All stainless steel table tops shall be 14 gauge polished stainless steel constructed as follows:

1. Edges shall be rounded and free from burrs and any excess material left. Tops shall be rolled 180°, 2" in diameter on all exposed sides. Where tables are placed against building walls, they shall be turned up in back approximately six inches, returned one inch diagonally to wall with all exposed ends welded closed. Corners shall be rounded or bullnosed. Top shall be reinforced 1-1/2" x 1-1/2" x 1/8" galvanized iron angle framework reinforcing, full perimeter of underside of top, with cross angles every 30" or less. Reinforcing shall be secured to the underside of the top with stud welds, lockwashers, and speed nuts.

2. Underbracing shall be provided for drainboards, and dishtable tops, and shall be 1" x 4" x 1" channels of 14 gauge stainless steel. Bracing shall be welded to the underside of fixtures in a manner suitable to seal out vermin and also to create a noise deadening top surface. All channels shall extend the full length and depth of fixtures and shall be so positioned that no dimension exceeds 30" in any direction.

3. Legs shall be constructed of not less than 1-5/8" o.d., 16 gauge stainless steel pipe. Legs shall be in no case spaced more than 6'-0" on centers. Leg cross bracing, where required, shall be constructed of not less than 1-1/4" o.d. x 16 gauge stainless steel tubing. All leg bracing shall run horizontal and level between all legs, approximately 10" above the floor, unless otherwise specified. All joints shall be completely welded around the entire perimeter.

C. Leg Mountings:

1. Units mounted on legs that are 14" or longer shall be provided with underbracing. Legs in such cases are to be provided with not less than 12 gauge stainless steel gussets, extending downward.

   Gussets shall be die stamped, fully enclosed, drawn cylindrical or cone shaped of not less than 3" in length, 2-1/2" in diameter at top. Gussets shall be welded continuously around entire circumference against the channel reinforcement.

2. On legs between 8" and 14" in height, gussets shall be provided, but no underbracing need be furnished.

D. Feet shall be stainless steel bullet type, Model No. A10-0851, as manufactured by "Component Hardware", or an approved equal, having an integrally formed shaft with a minimum adjustment of approximately 1-1/2" without the use of threading or adjusting bolts. Feet shall be completely sealed at bottom and shall be close fitting between tubular leg support and foot.

E. Casters shall be heavy duty as manufactured by "Component Hardware", or an approved equal, diameter of casters and brakes as hereinafter specified.

F. Undershelving:

1. Flat undershelving shall be 16 gauge stainless steel turned down on front and sides approximately 1-1/2" and under 1/2" to form a channel shape. Rear of shelf to be turned up 2" and hemmed. Undershelves shall be reinforced with 1" x 4" x 1" 14 gauge stainless steel channel, full length of shelf. Shelves shall be notched to fit the contour of legs. Shelves shall be fully welded to legs, crevice free.

2. Slotted undershelving is to be constructed same as above except that die-stamped slots approximately 1-1/4" wide and 3" apart are to be furnished full length of shelf units running front to back.

3. Counter shelves and cabinet shelves shall be constructed of 16 gauge stainless steel. All shelves shall be of the removable type unless otherwise specified on drawings and constructed in sections of not more than 30".

G. Drawers shall be of the telescoping slide type with completely enclosed 16 gauge stainless steel housing. Provide drawers with 20" x 20" x 5" deep inside liner, Model No. S80-2020; 20" x 20" x 10" deep inside liner, Model No. S83-2020, all as manufactured by "Component Hardware", or approved equal to be removable without untracking, gray in color, smooth finish, all thermoplastic construction with all vertical and horizontal corners on a radius, with the top edges flanged out to set into a 16 gauge stainless steel track and housing combination. The housing combination shall operate on a 16 gauge stainless steel outside locking track. Fronts shall have 16 gauge stainless steel front panel with full-grip pull handles, Model No. P50-1011; locks hasp and staple, M80 Series(sized to suit); and heavy duty drawer slides, S52 Series, all as manufactured by "Component Hardware", or an approved equal. The drawer front shall be double wall type construction filled with an approved sound deadener within. Below specified drawer, there shall be a 21" x 24" x 1" thick, white thermoplastic carving board as manufactured by "John Boos Co.", or an approved equal. Boards to fit into stainless steel "Z" slides.

H. Wall Cabinets shall be of length as shown on plans or hereinafter specified 13" deep x 30" high, except if otherwise specified or shown on drawings. All cabinet shall have sloped, dust-proof tops. Exterior bottoms shall be of flush construction. Construct cabinet of 18 gauge polished stainless steel, of all welded construction. Cabinet interiors shall be provided with a fixed bottom shelf and two removable, adjustable, intermediate shelves. Shelves shall rest on clips, which shall be secured to keyhole strips fastened to interior of cabinet. Keyhole strips shall be Model No. T23 Series pilaster stainless steel removable thumbscrew type; shelf clips shall be Model No. T30-5032, all as manufactured by "Component Hardware", or an approved equal. Door shall be of double wall construction as specified.

I. Counter and Cabinet Doors:

1. Sliding doors shall be constructed of 18 gauge stainless steel exterior and 20 gauge stainless steel interior unless otherwise specified. Door shall be equipped with pull handles and key locks as specified. Doors shall be removable. Doors shall be double pan construction with all corners welded and shall be filled with an approved 1/2" thick sound deadener. Doors shall be provided to permit removal for cleaning and adjustment without the use of tools. Bolts and screws shall be kept to a minimum and shall be of corrosion resisting metal. Spacers, where not exposed to view, shall be 14 gauge 3/4" diameter stainless steel tubing. Upper suspension nylon rollers shall be heavy duty to fit stainless steel track so as to minimize wear and noise. Doors shall operate on rollers freely without friction or rubbing between doors, door suspensions and upper sliding framework including hardware.

2. Double sliding doors shall be provided with double overhead tracks and carriers for maximum clear door opening. Units shall be provided with trackless bottom with concealed guide for overhead roller doors. Guides shall be equipped with limit stops to prevent telescoping of doors.

3. Hinged doors shall be constructed of 18 gauge stainless steel exterior and 20 gauge stainless steel interior, with all corners welded and insulated with an approved sound deadener material within. Hinges, catches, door handles and locking devices shall be provided as hereinafter specified.

4. Plastic laminated hinged doors and removable panels shall be constructed of 3/4" thick marine plywood. Flake board, chip board, particle board or any variation of such is not acceptable. Doors and panels to be provided with finished plastic laminate on front and all edges; rear to be provided with backer sheets; all with edges banded. Plastic laminate to be applied to substrate with contact adhesive as recommended by plastic laminate manufacturer. Hinges, catches, touch-type releases and locking devices shall be provided as hereinafter specified.

   Note: This Contractor to verify all plastic laminate patterns, colors and finishes with architect.

J. Wall shelves shall be of length as shown on plans or hereinafter specified. All shelves shall be constructed of 16 gauge stainless steel, turned up 2" at both sides and rear, unless otherwise specified or shown on details. Rear shall be hemmed. Sides shall be fully welded and enclosed above and below shelf, flush with rolled edge as shown on details. Shelves shall be supported on 12 gauge stainless steel brackets spaced no more than 4'-0" o.c.. Brackets shall be welded to shelves as hereinbefore specified.

2.5 HANDLES, BRACKETS, LOCKING DEVICES AND HARDWARE:

A. Wherever equipment is provided with handles, knobs, hinges, brackets, or other miscellaneous hardware, all shall be either satin finish chrome plated or stainless steel. All pull handles to be of the full-grip type, Model No. P50-1011, as manufactured by "Component Hardware", or an approved equal.

B. All sliding and hinged doors and all drawers in tables, cabinets, refrigerators, storage bins, to be furnished with extra heavy duty security type locking devices of cylinder type, chrome plated. Keying for all locks whether used for doors, drawers, storage bins, etc., locking devices to be as manufactured by "Component Hardware", or an approved equal. Owner to verify preferred keying of all locks.

C. All stainless steel hinged doors shall be provided with stainless steel lift-off type hinges and adjustable tension type catches. Unless otherwise specified, each shall be fully mortised into doors and corresponding mullions to create a flush, clean appearance. All hinges shall be Model No. R74-8100 and R74-8101, as manufactured by "Component Hardware", or an approved equal. All catches shall be Model No. M27-2490, as manufactured by "Component Hardware ", or an approved equal.

D. All plastic laminated hinged doors to be furnished with Model No. 332 hinges, as manufactured by "Stanley", or an approved equal and catches to be Model No. 1860-A-35, as manufactured by "McMaster Carr", or an approved equal.

E. All mobile stands and tables to be provided with heavy duty casters; Model No. C25-1950 caster with Model No. C25-1951 brake in kitchen, and Model No. C23-3450 caster with Model No. C23-3451 brake in dishwashing area, as manufactured by "Component Hardware", or an approved equal.

2.6 MOTORS AND ELECTRICAL CHARACTERISTICS:

A. Motors:

1. Shall be of the drip-proof, splash-proof, or totally enclosed type having a two hour duty cycle and ball bearings (except small timing motors which may have sleeve bearings). All motors shall have windings impregnated to resist moisture. Motors shall have ample power to operate machinery for which designated, under full load operating conditions, without exceeding nameplate ratings.

2. Fractional horsepower motors 1/2 HP and above shall be supplied to operate on 208 volts, 3 phase, 4 wire, and shall be provided with a magnetic pushbutton unless otherwise called for in equipment schedule.

3. Motors 1/3 HP and under shall be 120 volt 60 cycle, single phase, provided with a manual starting switch with thermal overload, unless these motors shall be used for devices requiring automatic operation, in which case they shall be of the magnetic type with manual reset.

B. Heating Elements: Wherever heating elements are required for operation of kitchen equipment, each separate heating element shall be interconnected with a switch and pilot light. Where a single element

has a three setting, the switch shall have a multiple setting, consisting of high, medium, low and off positions.

C. Portable Equipment: Electrically operated portable equipment shall have a ground wire and a polarized plug approved for use with the type of receptacle of installation.

2.7 FAUCETS, VALVES, FITTINGS:

A. Faucets, valves and fittings shall be as follows:

1. Dishwashing machine shall have a pressure regulator valve set for twenty pounds discharge pressure. Valves shall be self-regulating and shall have a manual adjustment range between 15-30 pounds. Valve bodies and working parts shall be of brass.

2. Provide an approved anti-water hammer device for dishwashing machine, consisting of synthetic rubber chamber cased in steel housing. Devices utilizing air chambers or coiled copper tubing shall not be accepted.

3. Faucets shall be furnished for all sinks according to schedule.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS:

A. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Engineer.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION:

A. The installation and erection of all kitchen and cafeteria equipment specified in this section shall be performed under the supervision of an approved representative of the kitchen equipment contractor and in strict accordance with the specifications and the approved printed directions of the manufacturer.

3.3 PROTECTION OF WORK:

A. For the period during which other trades shall be on or near equipment and/or work covered by this Contract, this contractor shall cover and protect the exposed surfaces of such equipment in a manner that shall preclude injury to the finish by absorption of oil, grease, chemicals, etc., contact from tools and machinery, and from all other causes which may be incidental to operation performed in the area. Should this Contractor fail to protect his work in the specified manner, he shall absorb all expenses for such work.

3.4 CLEANING:

A. When all the work covered by this Contract, together with the work of other trades has been completed, the equipment contractor shall clean each and every item of equipment so that all traces of grease, stains, protective coatings, abrasive dust, markings, scratches, and other foreign matter are completely removed. The cleaning process shall be one which shall eliminate any further cleaning on the part of the Owner with the exception of that which would ordinarily be undertaken daily to maintain accepted standards of sanitation and appearance.

3.5 TESTINGS:

A. Tests of all equipment shall be performed in the presence of the authorized representative of the respective manufacturers. All defects disclosed by the tests shall be eliminated to the satisfaction of the Architects and the corrected areas retested.

B. Provide necessary technicians, materials, and equipment required to conduct these tests. A statement shall be furnished by the Architect showing the schedule of testing, date, and results.

3.6 MAINTENANCE:

A. Equipment described herein shall be provided with service at no cost to the Owner, for a period of one year after final acceptance of the building. This service shall also include adjustment of all equipment. It shall also include repair or replacement of electrical and mechanical parts of the equipment whenever this is required during maintenance periods, and only genuine standard parts produced by the manufacturer of the equipment shall be used. Renewals and repairs, as necessary, due to ordinary wear and tear, shall be included as part of this maintenance service. All work under this maintenance and call-back provision shall be performed by competent personnel under the manufacturer's supervision. Work shall be done during the regular working hours and days, but local call-back emergency service shall be available at all times.

B. For the refrigeration systems, local service at no cost to the Owner, on a twenty-four hour per day call basis shall be provided for a period of one year from date of initial start-up. A representative of the local servicing organization shall be present at a start-up and adjustment of the various systems and shall become thoroughly familiar with the requirements and characteristics of each system.

C. In addition to the above, all hermetically sealed units shall be furnished with a warranty for a period of five years from after final acceptances and installation.

D. Provisions shall be made for properly trained authorized personnel to demonstrate to the Owner's operators the operation of all equipment including refrigeration systems. In addition, four (4) complete printed copies of the instructions shall be furnished to the Owner, covering the operation and maintenance of all equipment. This information shall be submitted in the following manner for initial review by the Architect, prior to use by the Owner:

1. A covered, bound booklet containing Manufacturer's current printed Installation/Operation/Maintenance/Parts manuals for all equipment hereinafter specified (including all accessories, components, faucets, etc.). Each manual shall be clearly labeled with their respective item number designation as hereinafter specified.

2. Booklet shall include a Table of Contents listing each equipment item included within the booklet, complete with corresponding item number, quantity and description as hereinafter specified.

3. Booklet shall also include a Service Agency Listing. This listing shall include the complete name, address and phone number of the local Service Agency for all equipment included within the booklet.

3.7 SPECIAL NOTES:

A. The installation and erection of all Food Service equipment shall be performed under the supervision of an approved representative of the Food Service Equipment Manufacturer in strict accordance with the specifications and the approved printed directions of the Manufacturer.

B. Dimensions given herein are approximate only, and in all cases where equipment is intended to occupy fixed locations and spaces, the physical conditions of the building are to control the absolute sizes.

C. Furnish steam pressure reducing valves as required for steam operated units.

D. Provide locks for standard manufactured refrigerator and freezer doors, drawers, cabinet doors, etc.

E. All penetrations in any work table or serving counter tops required to run mechanical services to any equipment items located on same shall be fitted with rubber grommets to protect these service lines (unless otherwise noted) on the Contract Documents.

F. All troughs and drains related to tilting kettles and skillets must be positioned in such a manner so as to fall within the pour pattern required. This Contractor to coordinate with all applicable trades.

G. Existing Equipment:

1. Prior to submitting bid, the Contractor shall visit the existing kitchen and inspect all equipment that will be re-used. If any deviations occur between these specifications and actual conditions, he shall notify the Architect immediately. If the Architect is not notified during the bid period, it will be assumed that all necessary refurbishing of existing equipment is fully understood.

   All existing equipment that is mechanically operated, such as kettles, ranges, refrigerators, slicers, etc., shall be checked for operation. This Contractor to verify all electric and plumbing requirements and shall provide and install all parts required to put equipment in good operating condition. Equipment shall be cleaned and refurbished as required to put it in neat and good condition subject to Architect's approval.

2. Removal of existing equipment not reused shall be the responsibility of the General Contractor.

3. Relocation of existing equipment from present location, storage as well as to new location shall be responsibility of this Contractor.

4. All existing equipment from this facility shall be disconnected by the General Contractor. After the equipment has been disconnected by the General Contractor, it shall be the responsibility of the Food Service Equipment contractor to remove and transport all existing equipment to be re-used to location designated by the Owner. All existing equipment to be re-used will be cleaned and refurbished in good working condition. After the existing equipment is cleaned and refurbished, it will be the responsibility of the Food Service contractor to transport and relocate the equipment to the position as shown on plan and made ready for final connection by the various trades. Once the equipment is installed, it shall be the responsibility of the Food Service contractor to provide the

   proper start-up and demonstrations as specified. All conditions of Division 11 Section 11400 of the specification shall apply to this equipment.

END OF SECTION

SECTION 12 36 61.19

QUARTZ AGGLOMERATE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Quartz agglomerate countertops.
   2. Quartz agglomerate backsplashes.
   3. Quartz agglomerate end splashes.
   4. Quartz agglomerate apron fronts.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
   1. Show locations and details of joints.
   2. Show direction of directional pattern, if any.

C. Samples for Verification: For the following products:
   1. Countertop material, 6 inches (150 mm) square.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
   1. Build mockup of typical countertop as shown on Drawings.
   2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.6 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
      a. Cambria.
      b. Cosentino USA.
      c. E. I. du Pont de Nemours and Company.
      d. LG Chemical, Ltd.
      e. Meganite Inc.
      f. Samsung Chemical USA, Inc.

g. Technistone USA, Inc.
h. Transolid Div of Trumbull Industries.
i. Wilsonart.

2. Colors and Patterns: As scheduled.

B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

C. Wire-Management Grommets: Circular, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Products: Subject to compliance with requirements, provide the following:
a. Doug Mockett & Company, Inc.: TG Flip-Top Series.
2. Outside Diameter: 2 inches (51-mm).
3. Color: As selected by Architect from Manufacturer’s full range.

D. Countertop Support Brackets: Steel, 18 inches by 24 inches, minimum 1,000 lb load limit, factory-applied primer for field painting in accordance with Section 099123 "Interior Painting."
1. Acceptable Products:
a. A & M Hardware; Work Station Brackets.
1) Provide manufacturer’s standard factory-applied primer. Refer to Section 099123 “Interior Painting” for finish coat.
2) Provide manufacturer’s standard black textured powder coat finish.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."
1. Grade: Custom.

B. Countertops: 1/2-inch- (12.7-mm-) thick, quartz agglomerate.

C. Backsplashes: 1/2-inch- (12.7-mm-) thick, quartz agglomerate.

D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
1. Fabricate with loose backsplashes for field assembly.

E. Joints: Fabricate countertops without joints.

F. Cutouts and Holes:
1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by quartz agglomerate manufacturer.

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.

B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

D. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

E. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

F. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.

G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
   1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

H. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION

SECTION 21 00 10
BASIC FIRE PROTECTION REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS AND SUPPLEMENTAL GENERAL PROVISIONS

A. The "General Conditions" and "Supplementary Conditions" are by reference made a part of this section and shall apply to each and every heading as though included herein.

B. In the event of conflict, the requirements of the "General Conditions" and "Supplementary Conditions" will take precedence over these "General Requirements".

1.02 GENERAL

A. The Contractor shall provide all plans, labor, equipment, appliances and materials, and shall perform all operations in connection with the installation of the fire protection work in accordance with the Specifications, applicable drawings, and the conditions specified above.

B. Contractor shall provide all equipment required and usually furnished in connection with such work and systems whether or not specifically mentioned or specifically indicated on the drawings.

1.03 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and become familiar with the existing work conditions, hazards, grades, actual formations, soil conditions, and local requirements. The submission of bids shall be deemed evidence of such visits.

B. 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.

C. The trade furnishing the equipment shall be responsible for notifying the Contractor prior to ordering it, in the event that equipment specified and/or reviewed is incompatible with this requirement.

1.04 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

A. Refer to other sections of the specifications for construction phasing and time increments.

B. The Contractor shall obtain and pay for all required utility connections, impact fees, utility extensions and/or relocations and shall pay all costs and inspection fees for all work included herein.

1.05 APPLICABLE CODES AND STANDARDS

A. The installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of the Specifications, except as may be hereinafter modified in these Specifications and associated drawings.

B. Latest edition of the National Fire Protection Association Standards (NFPA):

1. NFPA No. 13 Installation of Sprinkler Systems
2. NFPA No. 14 Installation of Standpipes and Hose Systems
3. NFPA No. 24 Installation of Private Fire Service mains and their Appurtenances
4. NFPA No. 70 National Electrical Code
5. NFPA No. 90A Installation of Air Conditioning and Ventilating systems
6. NFPA No. 91 Exhaust systems of Air Conveying of Gases, etc.
7. NFPA No. 96 Ventilation control and Fire Protection of Commercial Cooking Operations
8. NFPA No. 101 Safety to Life from Fire in Buildings and Structures
9. NFPA No. 255 Test of Surface Burning Characteristics of Building Materials

C. United States of America Standards Institute (ASA) Standards:

1. A40.8 National Plumbing Code
2. B31.1 & B31.1a Code for Pressure Piping

D. American Society of Mechanical Engineers (ASME): Boiler and Pressure Vessel Codes.
E. Air Conditioning and Refrigeration Institute Standards (ARI): All standards related to refrigeration and air conditioning equipment and piping furnished under these Specifications.
F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) 1985: All applicable manuals and standards.
G. American Society of Testing and Material (ASTM): All applicable manuals and standards.
H. American Water Works Association (AWWA): All applicable manuals and standards.
I. National Electrical Manufacturer's Association (NEMA): All applicable manuals and standards.
J. City Fire Department as applicable to construction of this site.
K. City and State Building Codes.
L. State of Texas Occupational Safety Act: Applicable safety standards.
M. Refer to Specifications sections hereinafter bound for additional codes and standards.
N. All materials and workmanship shall comply with all applicable state and national codes, specifications, and industry standards. All material shall be listed by the Underwriter's Laboratories, Inc., as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.
O. The Contract Documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by other specifications of the Contract Documents, providing no work or fabrication of materials has been accomplished in a manner of non-compliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

1.06 CONTRACT DOCUMENTS

A. These specifications are accompanied by drawings of the building and details of the installations indicating the locations of equipment, piping, ductwork, outlets, switch controls, circuits, lines, etc. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
B. If the Contractor deems any departures from the drawings necessary, details of such departures and the reasons therefore shall be submitted to the Architect for review. No departures shall be made without prior written acceptance.
C. There are intricacies of construction that are impractical to specify or indicate in detail; however, in such cases the current rules of good practice and applicable specifications shall govern.
D. It is the Contractor's responsibility to properly use all information found on the Civil, Architectural, Structural, Mechanical and Electrical drawings where such information affects their work.
E. All dimensional information related to new structures should be taken from the appropriate drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.
F. The interrelation of the specifications, the drawings, and the schedules is as follows: The specifications determine the nature and setting of the several materials, the drawings establish the quantities, dimensions and details, and the schedules give the performance characteristics.

G. Should the drawings or specifications disagree within themselves, or with each other, the better quality of greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Architect in writing, shall be performed or furnished. Figures indicated on drawings govern scale measurements and large-scale details govern small-scale drawings.

1.07 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of fire protection, plumbing, mechanical, and electrical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared to indicate a suitable arrangement.

B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

C. Maintain all Code required clearances for equipment access.

1.08 FABRICATION DRAWINGS

A. Each contractor shall submit shop drawings whenever (1) equipment proposed varies in physical size and arrangement from that indicated on the drawings, thus causing rearrangement of equipment space, (2) where tight spaces require extreme coordination between ductwork, piping, conduit and other equipment, and (3) where called for elsewhere in the specifications.

B. All required shop drawings, except as hereinafter specified, shall be prepared at a scale of not less than 1/8 inch equal to 1 foot.

1.09 SUPERVISION

A. Each contractor shall keep a competent superintendent or foreman on the job at all times necessary for the timely and proper completion of the work.

B. It shall be the responsibility of each superintendent to study all drawings and become familiar with the work to be done by other trades. The Contractor shall coordinate this work with other trades, and before material is fabricated or installed, make sure that the work will not cause an interference that cannot be resolved without major changes to the drawings. If a conflict between trades arises that cannot be resolved at the jobsite, the matter shall be referred to the Architect for their ruling.

1.10 EXISTING FACILITIES

A. The Contractor shall be responsible for loss or damage to the existing facilities caused by themselves and their workers, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all plumbing, heating, air conditioning, and ventilating services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, and remove all such temporary protection upon completion of the work. All barricades and safety devices shall be in compliance with OSHA.

B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, all Contractors shall remove and reinstall, in locations approved by the Architect, all devices required for the operation of the various systems installed in the existing construction. This is to include, but is not limited to, temperature control system devices, electrical switches, relays, fixtures, piping, conduit, etc.

E. Outages of services, as required by the new installation, will be permitted only at a time approved by the Architect.

1.11 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition.

B. All items that are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed and sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Architect. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas of facilities, which must remain in operation during the construction period, shall not be interrupted without prior specific approval of the Architect as hereinbefore specified.

D. All equipment and materials indicated to be removed and not be re-used shall be disposed of by the Contractor.

1.12 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall prepare, in triplicate for the Owner's Manual, complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc., for each item of equipment. Include copies of all equipment warranties.

B. In addition, the Contractor shall provide the services of a competent engineer or a technician acceptable to the Architect to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of not less than 8 hours to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, stating the dates of instruction and the personnel to whom instructions were given. The Contractor shall be responsible for proper maintenance until the instructions have been given to the Owner's maintenance personnel.

1.13 GUARANTEE

A. All work and equipment shall be guaranteed for a period of one year from the date of substantial completion.

B. Guarantee shall be for all labor and materials.

C. Certain items for equipment shall have additional or extended warranties when so specified.

1.14 MATERIALS AND WORKMANSHIP

A. All materials, unless otherwise specified, shall be of current U.S. manufacture, new, free from all defects, and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall present a neat, workmanlike appearance. Materials, and/or equipment damaged in shipment, or otherwise damaged prior to installation, shall not be repaired at the job site, but shall be replaced with new materials and/or equipment.

B. The responsibility for furnishing the proper equipment and/or material, and to see that it is installed as intended by the manufacturer rests entirely upon the Contractor, who shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

1.15 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials and adhesives incorporated in this project shall conform to NFPA 255, latest edition. The classification shall not exceed No. 2, with the range of indices between 0 to 25 for these Classifications as listed in the Federal Specifications. Modifications shall be made to insulating materials, etc., as required to comply with the Federal Specification.

1.16 LARGE APPARATUS

A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

1.17 SLEEVES, INSERTS AND FASTENINGS

A. Proper openings through floors, walls, roofs, etc., for the passage of piping, ductwork, etc., shall be provided. All penetrations must pass through sleeves except soil pipe installed under concrete slabs on fill. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Architect.

B. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.

C. The minimum clearance between horizontal penetrations including insulation where applicable, and sleeves shall be 1/4 in., except that the minimum clearance shall be 2 in. where piping contacts the ground. Sleeves through walls and partitions shall be installed flush with exposed surfaces. Sleeves through floors shall be extended 2 in. above finished floor.

D. Above grade and dry location sleeves shall be constructed from 20 to 22 gauge galvanized steel. Sleeves passing through walls or floors on or below grade and/or moist areas such as mechanical rooms shall be constructed of galvanized steel Schedule 40 pipe and shall be designed with suitable flange in the center of the floor or wall to form a waterproof passage. After the pipes have been installed in the sleeves, void space around the pipe shall be sealed with "Link-Seal" modular wall and casing seals as manufactured by Thunderline Corporation.

E. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction.

F. Fastening of pipes, conduits, etc., in the building shall be as follows: To wood members - by wood screws; to masonry - by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry; to steel - machine screws or welding (when specifically permitted or directed), or bolts, and to concrete by suitable inserts anchored to reinforcing steel, and poured in place unless other means are acceptable for general use, and will only be permitted where specifically acceptable to the Architect.

G. Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.

H. Vermin Proofing: The open space around all ductwork, piping, etc., passing through the ground floor and/or exterior walls shall be sealed with a continuous bead of sealant.

I. The space around piping, ductwork, etc., penetrating walls, ceilings and floors that define air plenums shall be sealed airtight in an acceptable manner. Ceiling plenums used for return air are considered air plenums.

1.18 ACCESS DOORS

A. This Contractor shall provide wall or ceiling access doors for unrestricted access to all concealed shutoff, service or drain valves, and other items of concealed fire protection equipment. All access door locations are not shown on the drawings. It is the Contractor's responsibility to provide access doors at all locations required.

B. Access doors mounted in painted surfaces shall be equal to Milcor (Inland-Ryerson Construction Products Company) manufacture, Style K for plastered surfaces and Style M or DW for non-plastered surfaces. The Style K doors shall be set so that the finished surface of the door is even with the finished surfaces of the adjacent finishes. Access doors mounted on tile surfaces shall be stainless steel materials. Access doors shall be minimum of 18 in. x 18 in. in size.

1.19 CONSTRUCTION REQUIREMENTS

A. The Civil, Architectural, Structural, Mechanical, Plumbing, and Electrical plans and specifications including the General Provisions, Supplemental General Provisions, and other pertinent documents issued by the Architect, are a part of these specifications and the accompanying fire protection drawings, and shall be complied with in every respect. All the above is included in the Contract Documents, and shall be examined by all bidders. Failure to comply shall not relieve the Contractor of responsibility or be used as a basis for additional compensation due to omission of architectural, structural and electrical details from the fire protection drawings.

B. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems or required to complete the installation, whether mentioned or not.

C. The Contractor shall be responsible for fitting their material and apparatus into the building and shall carefully lay out their work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation supplied by the manufacturer of the equipment to be installed and thereby to provide an integrated satisfactory operating installation.

D. The fire protection and associated drawings are necessarily diagrammatic in character and cannot show every connection in detail or every pipe or equipment in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate pipe hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc., shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

E. When the drawings do not give exact details as to the elevation of pipe, ducts, etc., physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Piping and duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner, and the plans do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas. Piping specified to be insulated shall be supported in a manner that will allow the insulation to be installed without gaps. Insulated piping in concealed areas shall be offset with fittings as necessary to permit installation of insulation. Bending of pipes or installing pipes in a strain in order to insulate will not be permitted.

F. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Equipment shall be so located and installed as to permit convenient and safe maintenance and future replacement. Piping, ductwork, valve stems, etc., shall not block service space.

1.20 FIRE PROTECTION SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary) and Division 01 Section: "SUBMITTAL PROCEDURES" for submittal definitions, requirements, and procedures.

B. Submittal of Shop Drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from Subcontractors and material suppliers directly to the Architect will not be processed.

C. Submit Shop Drawings, product data, and samples on items indicated in the individual sections.

D. Shop Drawings and submittal data shall not be used as requests or proposals for alternate equipment or materials. Refer to Item "Product Options and Substitutions" elsewhere in this section.

E. THIRD PARTY CERTIFICATION: All Packaged equipment shall be independently Third Party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399, as well as NFPA Pamphlet #70, National Electric Code (NEC), Article 90-7.

1.21 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and the Division 01 Section "SUBSTITUTION PROCEDURES" for requirements in selecting products and requesting substitutions.

B. Standards for Materials:

1. These specifications indicate a standard for all materials incorporated into the work, with manufacturer's names and catalog numbers used to establish a grade and quality of materials and equipment. The manufacturer listed on the equipment schedules, or named first in the specifications, is the one on whose equipment the layout is based. Other named manufacturers must meet the indicated performance and space requirements.

2. The "approved equal" clause used in these specifications is to permit the proposal of unnamed manufacturer's products for the work, and the Architect/Engineer's decision concerning equal products is final.
3. Considerations as to determination of equal products include, but are not limited to, the following:

	Materials	Physical Size
	Workmanship	Weight
	Gauges of Materials	Appearance
	Available Local Service Personnel	Performance
	Previous successful installations	Capacity
	Delivery Schedules	Required Equipment Clearances

C. Requests for substitutions for equipment, materials and apparatus listed in Division 21 Sections must be submitted in writing a **MINIMUM OF 10 DAYS** prior to the scheduled bid date. Such requests must be accompanied by complete data to permit proper evaluation.
D. BIDS SHALL NOT BE BASED ON UN-APPROVED MATERIALS, EQUIPMENT, OR APPARATUS. UNAPPROVED MATERIAL, EQUIPMENT OR APPARATUS WILL NOT BE ACCEPTED.
E. Should electrical, water, drain, natural gas, structural support, or other similar requirements for alternate equipment, whether named in the specifications or approved as a substitution, be different from requirements for the products used in laying out the project, such changes shall be the responsibility of the Contractor, and shall not result in extra charges to the Owner or Architect/Engineer.

1.22 RECORD DOCUMENTS

A. Refer to the Division 01 Section: "CLOSEOUT SUBMITTALS" for requirements. The following paragraphs supplement the requirements of Division 01.
B. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned for column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.
C. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

1.23 PAINTING

A. Field painting of fire protection equipment, piping systems, etc., shall be accomplished under Division 09 of these specifications.
B. Protection of Factory-applied Finishes:
   1. Factory-applied finishes on equipment and apparatus installed on the project shall be carefully protected.
   2. At the conclusion of the work, and prior to final acceptance of the project, equipment and apparatus shall be thoroughly cleaned of all construction dirt, oil and grease smears, temporary labels, debris, paint droppings, etc.
   3. Damaged factory finishes shall be restored to their original condition using procedures, materials and application techniques as set forth in Division 09 found elsewhere in these specifications.

1.24 CLEANING

A. Refer to the Division 01 Section: "CLOSEOUT SUBMITTALS" for general requirements for final cleaning.

B. Name Plates:
   1. All nameplates shall be protected from damage during the construction process.
   2. At the conclusion of the work, the nameplates shall be carefully cleaned and left in a fully legible condition.

C. Removal of Rubbish: Each Contractor is responsible for the timely removal of rubbish and trash generated by their work, such as empty cartons, containers, materials crates, etc. Particular attention is called to residue that may present a potential tripping or injury hazard.

1.25 MOTORS AND DRIVES

A. Motors:
   1. General: Motors shall be U/L-approved, with copper windings, and with a minimum Service Factor of 1.15. The nominal capacity shall exceed the brake horse-power requirements at duty schedules.
   2. Motors 1/2 HP and smaller shall be 120-volt, single-phase with internal overload protection.
   3. Motors 3/4 HP and larger shall be 208/230 or 460-volt, 3-phase, unless scheduled or noted otherwise, and shall have thermal over-load cutouts in each phase as recommended by the motor manufacturer.
   4. Motors shall be as manufactured by Century, General Electric, US Motors, Wagner, Westinghouse, or approved equal.

B. Specific requirements:
   1. Provide high-efficiency motors for the following:
      a. Air-Handling Units, as scheduled.
      b. Ventilating Fans, as scheduled.
      c. HVAC Pumps, as scheduled.
   2. Efficiency ranges shall be as follows:

Nominal HP	Minimum Efficiency	Premium Efficiency
3	86.5	89.5
5	87.5	89.5
7.5	88.5	91.7
10	89.5	91.7
15	91.0	92.4
20	91.0	93.0
25	91.7	93.6
30	92.4	93.6
40	93.0	94.1
50, 60, 75	93.0, 93.6, 94.1	94.5, 95.0, 95.4
100	94.1	95.4

   3. Motor efficiency certification shall be included with Product Submittal Data in accordance with Division 01 of these specifications.
   4. Variable Speed (Frequency) AC Drives:
      a. Where scheduled on the plans, provide and install variable speed (frequency) AC drives for motors.
      b. Variable speed (frequency) AC drives shall be as described in Section 238965 of these Specifications.
   5. Motor Starters and Controllers:

a. Motor starters and controllers for fans, pumps, air-handling units, compressors, etc., which are not provided as an integral part of a factory-assembled package, shall be provided under Division 23 of the specifications. Refer to Section 238965.

PART 2 - PRODUCTS

2.01 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer's materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such instructions from the Architect, he shall bear all costs arising in connection with the deficiencies.

B. The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage.

C. Capacities shall be not less than those indicated but shall be such that no component or system becomes inoperative or is damaged because of start-up or other overload conditions.

D. Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriter's Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers, the Contractor shall submit proof that the items furnished under these sections of the specifications conform to such requirements. The ASME stamp will be acceptable as sufficient evidence that the items conform to the respective requirements.

E. Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Observation.

F. Standard factory finish will be acceptable on equipment specified by model number; otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking, and no signs of rust creepage beyond 1/8 in. on either side of the scratch mark. Where rust-inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable, unless a specific coating is specified, except that coal tar or asphalt type coatings will not be acceptable, unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-6215.

G. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

H. The Contractor shall be responsible for the coordination and proper relation of their work to the building structure and to the work of all trades. The Contractor shall visit the premises and become familiar with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Architect of any discrepancy before performing any work. Adjustments to the work required, in order to facilitate a coordinated installation, shall be made at no additional cost to the Owner.

2.02 PROTECTION

A. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.

B. Take particular care not to damage the building structure in performing work. All finished floors, steel treads, and workmen or their tools and equipment shall cover finished surfaces to prevent any damage during the construction of the building.

C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final observation must be cleaned of rust and repainted as specified elsewhere in these specifications.

2.03 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

A. Each trade, subcontractor and/or contractor must work in harmony with the various other trades, subcontractors, and/or contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or contractor must pursue the work promptly and carefully as not to delay the general progress of the job. This Contractor shall work in harmony with contractors working under other contracts on the premises.

2.04 PRECEDENCE OF MATERIALS

A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the available space, and which will insure complete and satisfactory systems. Each Contractor shall be responsible for the proper fitting of their own material and apparatus into the building.

B. Each Contractor shall so harmonize their work with that of the other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines that require a stated grade for proper operation. Where space requirements conflict, the following order of precedence shall, in general, be observed:

1. Building lines
2. Structural members
3. Drain piping
4. Vent piping
5. Steam piping
6. Condensate piping
7. Refrigerant piping
8. Electrical bus duct
9. Supply ductwork
10. Return ductwork
11. Exhaust ductwork
12. Chilled water and heating water piping
13. Automatic Fire Protection Sprinkler Piping
14. Natural gas piping
15. Domestic hot and cold water piping
16. Electrical conduit

2.05 LOCATION OF OUTLETS IN ROOMS

A. All fire protection, plumbing, acoustical tile, diffusers, grilles, registers, and other devices shall be referenced to coordinated, established data points and shall be located to present symmetrical arrangements with these points and to facilitate the proper arrangements of acoustical tile panels and other similar panels with respect to the mechanical and electrical outlets and devices. Those mechanical and electrical outlets shall be referenced to such features as wall and ceiling furrings, balanced border widths, masonry joints, etc. Outlets in acoustical tile shall occur symmetrically in tile joints or in the center of whole tiles. When locations of mechanical and electrical devices shown on the Architect's reflected ceiling plans need to be modified, the final determination of the exact location of each outlet and the arrangement to be followed shall be acceptable to the Architect.

B. The drawings show diagrammatically the location of the various outlets and apparatus. Exact locations of these outlets and apparatus shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with the other trades. The Architect reserves the right to make any reasonable change in location of any outlet or apparatus before installation, without additional cost to the Owner.

C. The Contractor, by submitting a bid on this work, sets forth that they have the necessary technical training and ability, and that they will install their work in a satisfactory and workmanlike manner which is up to the best standards of the trade, complete, and in good working order. If any of the requirements of the drawings and specifications are impossible of performance, or if the installation, when made in accordance with such requirements, will not perform satisfactorily, the Contractor shall report it to the Architect for correction promptly after discovery of the discrepancy.

PART 3 - INSTALLATION

3.01 INSTALLATION METHODS

A. All pipes shall be concealed in pipe chases, walls, furred spaces, or above the building, unless otherwise indicated.

B. Piping may be run exposed in mechanical rooms, janitors' closets, or storage spaces, but only where necessary. All exposed piping shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines.

C. All piping shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.

D. Where limited space is available above the ceilings and below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, in a manner to provide maximum above-floor clearance. Sleeves shall be as specified or as required.

E. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes and conduits run, exposed in machinery and equipment rooms, shall be installed parallel to the building plans, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.

F. There shall be no pipe joints nearer than 12 in. to a wall, ceiling, or floor penetration, unless pipe joint is the welded type joint.

G. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur, the Contractor shall meet with all involved trades and the Architect and resolve the conflict, prior to erection of any work, in the area involved.

3.02 CUTTING AND PATCHING

A. Cut and patch openings through walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction.

B. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills at locations acceptable to the Architect. Impact-type equipment will not be used, except where specifically acceptable to the Architect. Openings in Precast concrete slabs for pipes, conduits, outlet boxes, etc., shall be core drilled or cast to exact size.

C. All openings shall be restored to "as-new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.

D. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect.

E. All fire protection work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

F. No cutting, boring, or excavating, which will weaken the structure, shall be undertaken. NO STRUCTURAL MEMBER MAY BE CUT WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECT.

3.03 ROOF PENETRATIONS

A. Pipe and duct sleeves and flashings compatible with the roofing installation shall be provided for roof penetrations. Manufacturer of roofing materials shall approve methods and materials.

1. Pitch pans are not acceptable.

3.04 FABRICATION OF PIPE

A. All the various piping systems shall be made up straight and true and run at proper grades to permit proper flow of the contained material. Lines shall also be graded for proper drainage.

B. Piping shall follow as closely as possible the routes shown on plans, but shall take into consideration conditions to be met at the site.

C. Should any unforeseen conditions arise, lines shall be changed or rerouted as required after approval has been obtained.

D. All piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping, in connections, and in equipment to which lines are connected.

E. All piping shall be clean when it is installed. Before installation it shall be checked, upended, swabbed, if necessary, and all rust or dirt from storage shall be removed. Pipe shall not be permitted to lie on the ground during storage. Pipe ends shall be sealed during storage.

3.05 IDENTIFICATION AND LABELING

A. The Contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, valves, piping, etc., by marking them.

B. The Contractor shall install identification tags to be affixed to those valves that have functions that are not obvious. For example, it would not be expected that valves at a pressure reducing station in a machine room would be tagged. The valve identification tags shall be brass discs, 2 in. in diameter. Each tag shall be attached to its valve with copper clad annealed iron wire or other approved material.

3.06 TESTS AND INSPECTIONS

A. The Contractor shall, during the progress of the work and upon its completion, test their work and make all tests as required by the specifications, state, municipal and other authorities having jurisdiction of the work. Piping pressure tests shall be made before pipe is concealed or covered. Tests shall be made in the presence of authorities requiring tests. The Contractor shall pay all costs, inspection charges and fees required for the tests of their work.

B. The Contractor shall provide all apparatus, temporary piping connection, etc., required for tests. The Contractor shall take all due precautions to prevent damage to the building or its contents incurred by such tests. The Contractor shall repair and make good at their own expense any damage caused by failures or leaks during the tests.

C. Leaks, defects or deficiencies shall be repaired and/or replaced, and tests shall be repeated until the test requirements are complied with fully.

D. All equipment shall be placed in operation and tested for proper automatic control before the final balancing of the system is started.

E. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description, and extent of system tested, test condition, test results, specified results, and any other pertinent data. Data shall be delivered to the Architect.

3.07 COOPERATION AND CLEANUP

A. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of their tools, equipment and materials and shall clean their debris from the job. Upon the completion of the job, each trade shall immediately remove all of their tools, equipment, any surplus materials and all debris caused by their portion of the work.

3.08 CLEANING AND PAINTING

A. All equipment, piping, ductwork, grills, insulation, etc., in finished areas furnished and installed by the Contractor shall be painted. Finished areas include mechanical rooms, boiler rooms, and outside the building as well as occupied areas inside the building. Final painting is to be done by the General Contractor. This Contractor shall thoroughly clean all part of materials and equipment of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.

B. This Contractor shall thoroughly clean the finish on all parts of the materials and equipment with factory applied finishes. Exposed parts in equipment rooms, above crawl space slabs, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. If the finish has been damaged, the Contractor shall re-paint to the satisfaction of the Architect.

C. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during painting operation.

3.09 ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

A. The extent of electrical provisions to be provided as fire protection work is indicated in other sections of the specifications, on the drawings and as further specified in this section.

B. Starters, Controllers: In general, fire protection work includes furnishing combination starters. Controllers are specifically included as electrical work when mounted in motor control centers. Electrical work includes installation, mounting and wiring of starters and controllers that are furnished as mechanical work. Free standing, large motor controllers shall be set in place, on pads, as fire protection work.

C. Wherever possible, match the elements of the electrical provisions of fire protection work with similar elements of the electrical work specified in electrical sections of the specifications.

D. Standards:

1. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards to definitions of terminology herein.
2. Comply with National Electrical Code (NFPA No. 70) for installation requirements.
3. Comply with National Electrical Contractors Association (NECA) "Standard of Installation".

3.10 TEMPORARY FACILITIES

A. Unless noted otherwise in the Supplementary General Conditions; provide temporary facilities.

3.11 EQUIPMENT INSTALLATION REQUIREMENTS

A. All fire protection equipment shall be furnished and installed complete and ready for use.

END OF SECTION

SECTION 21 05 06
FIRE PROTECTION DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Demolition of:
   1. Fire protection equipment and associated piping.
   2. Hanger and support devices.
   3. All other appliances or devices associated with equipment or devices to be removed.

1.02 QUALITY ASSURANCE

A. Perform all demolition and removal work necessary to arrive at the arrangement shown on the Contract Drawings.
B. Perform all operations in such a method to cause minimum damage to items to be relocated, salvaged, or to remain intact and in use.

1.03 JOB CONDITIONS

A. Perform site repair and removal of salvaged items at times approved by the Owner. Accomplish repair and removal of items in a continuous and diligent manner in order to limit interference with Owner's on-going operations.
B. Drawings may not indicate and specifications may not identify every item required to be moved or removed.
C. Before submitting bids, visit and examine the site of the work and become familiar with the scope of the work and the details of the demolition work to be accomplished.
D. Submittal of a bid will be evidence that such an examination has been made and the various details noted.
E. Claims for extra compensation because of additional labor, materials, or equipment required because of difficulties encountered, will not be recognized unless items were concealed at time of inspection of the Contract Documents. Bring all such items to the attention of the Owner's Representative and the Architect for their disposition before continuing with the work.
F. Execute demolition work in a manner to protect adjacent equipment and other existing items against damage.
G. Provide and erect lights, barricades, warning signs, and other items as required for protection of the Owner's employees, building occupants, and the public.
H. Maintain barricades in good condition throughout the project to substantial completion.
I. Control the dust resulting from demolition to prevent it from spreading the occupied areas of the building and to avoid creating a nuisance in the immediate surrounding area.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PROTECTION

A. Provide protection for all building elements, all items which are to remain, all occupants and all workers at all times, and in accordance with all requirements of the Owner.
B. Division 02.

3.02 PROTECTION OF BUILDING FROM THE WEATHER

A. Maintain weather protection for the space(s) being worked in at all times, and in accordance with all requirements of the Owner.
B. Division 02.

3.03 DEMOLITION

A. Perform demolition in accordance with all requirements of the Owner.
B. Division 02.

3.04 DISPOSITION OF MATERIALS

A. Dispose of all demolition items and materials in a legal off-site location.

B. Division 02.

3.05 RELOCATION AND REUSE OF PLUMBING ITEMS

A. Relocate items indicated on the Contract Drawings as required to accommodate the new construction. Remove, relocate and reconnect equipment and accessories that are to be reused.

B. Coordinate the work with the Electrical Contractor. Determine which items and equipment are to remain, to be relocated or to be removed. Perform the work consistent with the scope of the project.

C. Transport and store materials removed and designated for relocation as directed by the Owner's Representative.

D. Remove all salvage items not be reused or delivered to the Owner, from the property at the end of each workday.

E. Maintain full water, drain, electrical service, etc., to all equipment and apparatus that remains in service in the building.

3.06 CLEANING

A. Section 21 00 10 "BASIC FIRE PROTECTION REQUIREMENTS".

3.07 REMOVAL OF WATER

A. Be responsible for the removal of water in areas in which scheduled work is to be performed.

1. Remove water by pumping, siphoning, absorbent mopping, or compressed air brooming.
2. Do not use any method of removal that will cause damage to new or reused adjacent equipment or materials.

3.08 SCHEDULING

A. Schedule demolition in strict compliance with the Owner's instructions.

3.09 DISCONNECTION AND RECONNECTION OF UTILITIES

A. Do not disconnect or reconnect any utilities until notifying the Owner's Representative.

B. Notify the Electrical Contractor when requiring Electrical Disconnect or Reconnect.

END OF SECTION

SECTION 21 05 12
FIRE PROTECTION AND ELECTRICAL COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
B. Refer to Section 21 00 10 - BASIC FIRE PROTECTION REQUIREMENTS.
C. Refer to Section 22 00 10 - BASIC PLUMBING REQUIREMENTS.
D. Refer to Section 23 00 10 - BASIC MECHANICAL REQUIREMENTS.

1.02 SUMMARY

A. This Section describes the coordination between the Fire Protection, Plumbing, Mechanical and Electrical portions of the work.
B. This Section is included under the Division 21 portion of the Specifications as Section 21 05 12, under the Division 22 portion of the Specifications as Section 22 05 12, under the Division 23 portion of the Specifications as Section 23 05 12, and under the Division 26 portion of the Specifications as Section 26 05 12.

1.03 WORK INCLUDED

A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. **T**[illegible] **O**[illegible]:

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
1.	Equipment Motors	21/22/23	21/22/23	26
2.	Magnetic Motor Starters			
	a. Automatically controlled, with or without HOA switches	21/22/23	26	Notes 1,3,5
	b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment	21/22/23	22/23	Notes 1,3,5
	c. Manually controlled	21/22/23	26	Notes 1,3,5
	d. Manually controlled and furnished as part of factory wired equipment	21/22/23	26	Notes 1,3,5
	e. Furnished in Motor Control Centers	26	26	Notes 1,3,5
3.	Variable Speed (Frequency) AC Drives	22/23	26	Notes 1,4,5
4.	Line voltage thermostats, time clocks, etc., not connected to control panel systems	23	26	23
5.	Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached	22/23	22/23	22/23

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
	to ducts, pipes, etc.			
6.	Temperature control panels and time switches mounted on temperature control panels	23	23	23
7.	Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc.	23	23	Note 1
8.	Alarm bells furnished with equipment installed by Division 22 or 23	22/23	22/23	22/23
9.	Wiring to obtain power for control circuits, including circuit breaker	21/22/23	21/22/23	21/22/23
10.	Low voltage controls	21/22/23	21/22/23	21/22/23
11.	Fire protection system (sprinkler) controls	21	21	Note 8
12.	Fire and smoke detectors installed on mechanical units and in ductwork	28	23	Note 8
13.	All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment	23	23	Note 1
14.	Smoke dampers, and combination fire/smoke dampers	23	23	Note 7
15.	Boiler and water heater controls, boiler burner controls panels	22/23	22/23	22/23
16.	Pushbutton stations, pilot lights	22/23	22/23	22/23
17.	Heat Tape	21/22/23	21/22/23	26
18.	Disconnect switches, manual operating switches furnished as a part of the equipment	21/22/23	21/22/23	Notes 1,5
19.	Disconnect switches, manual operating switches furnished separate from equipment	26	26	26
20.	Multispeed switches	23	23	26
21.	Thermal overloads	21/22/23	21/22/23	21/22/23
22.	Control relays, transformers	21/22/23	21/22/23	21/22/23
23.	Refrigeration cycle, cooling tower and controls	23	23	23
24.	Tamper switches for fire	21	21	28

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
	protection (sprinkler) system			
25.	Flow and/or pressure switches for fire protection (sprinkler) system	21	21	28
26.	Fire and jockey pump controllers and automatic transfer switch	21	21	Note 6
27.	Alarm bells or horns for fire protection (sprinkler) system	21	21	28
28.	Generator (underground) fuel tank	22	22	--
29.	Generator fuel level indicator	22	22	26
30.	Generator fuel piping from tank to generator	22	22	--
31.	Underground fuel tank leak detection and monitoring system	22	22	22

NOTES:	(1)	Power wiring as defined in Section 26 29 13, of the specifications shall be provided under Division 26; control wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 21/22/23.
	(2)	Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 26 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 specifications, Division 26 and Drawings for more specific requirements.
	(3)	For requirements for Magnetic Motor Starters, refer to Section 23 89 65.
	(4)	For requirements for Variable Speed (Frequency) AC drives, refer to Section 23 89 65.
	(5)	Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.
	(6)	Power wiring from energy source to controllers and automatic transfer switch provide shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 21, 22 or 23 and conforming to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.
	(7)	Division 26 will provide power to all smoke and combination fire/smoke dampers, and Division 28 will provide control for all such dampers using area smoke detectors.

	(8)	Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

B. CONNECTIONS: Make all connections to controls that are directly attached to ducts, piping and mechanical equipment with flexible connections.

C. PRECEDENCE
   1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.
   2. Precedence for pipe, conduit and duct systems shall be as follows.
      a. Building lines
      b. Structural members
      c. Soil and drain piping
      d. Vent piping
      e. Condensate piping
      f. Refrigerant piping
      g. Electrical bus duct
      h. Supply ductwork
      i. Return ductwork
      j. Exhaust ductwork
      k. Chilled water and heating water piping
      l. Automatic Fire Protection Sprinkler Piping
      m. Natural gas piping
      n. Domestic hot and cold water piping
      o. Electrical conduit
   3. Lighting Fixtures shall have precedence over air grilles and diffusers.

D. FINAL INSPECTION AND REPORT
   1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical Fire Alarm and Temperature Control Contractors, representatives of mechanical and electrical equipment manufactures whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies that they represent, shall be filed with the Owner and Architect or Engineer.

END OF SECTION

SECTION 21 11 00
FIRE PROTECTION PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of Fire Protection Piping Work required by this section is indicated on Drawings and by requirements of this section.

B. This section includes pipe, fittings and valves for Fire Protection Systems. Types of Fire Protection Piping Systems specified in this section include the following:

1. Automatic Sprinkler Systems.
2. Standpipe and Hose Systems.

1.02 REFERENCES

A. ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
B. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300.
C. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.
D. ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings.
E. ANSI/ASME B16.9 - Factory-made Wrought Steel Buttwelding Fittings.
F. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-welding and Threaded.
G. ANSI/ASME B16.18 - Cast Copper Alloy Solder-Joint Pressure Fittings.
H. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
I. ANSI/ASME B16.25 - Buttwelding Ends.
J. ANSI/ASME B36.10 - Welded and Seamless Wrought Steel Pipe.
K. ANSI/ASME Section 9 - Welding and Brazing Qualifications.
L. ANSI/ASTM A135 - Electric-Resistance-Welded Steel Pipe.
M. ANSI/ASTM A47 - Malleable Iron Castings.
N. ANSI/ASTM B32 - Solder Metal.
O. ANSI/AWS A5.8 - Brazing Filler Metal.
P. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings.
Q. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast.
R. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.
S. ASTM A120 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated (Galvanized) Welded and Seamless, for Ordinary Uses.
T. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
U. ASTM B75 - Seamless Copper Tube.
V. ASTM B88 - Seamless Copper Water Tube.
W. ASTM B251 - General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
X. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.
Y. NFPA 13 - Installation of Sprinkler Systems, latest edition
Z. NFPA 14 - Installation of Standpipe and Hose Systems, latest edition.
AA. NFPA 24 - Installation of Private Fire Service Mains and their Appurtenances, latest edition.

1.03 QUALITY ASSURANCE

A. Conformance with applicable state and local codes and ordinances.
B. Welding Materials and Procedures: Conform to ASTM Code and AWS D1O.12.
C. Employ certified welders in accordance with ANSI/ASME Section 9.

D. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body.

1.04 REGULATORY REQUIREMENTS

A. Install in accordance with NFPA 13, NFPA 24, City Fire Codes and Ordinances, and the requirements of Owner's Insurance Underwriter.

B. Piping materials specified herein are acceptable products to the Architect but all are not necessarily acceptable to applicable local codes and ordinances. It is the responsibility of the Contractor to provide materials, from the options listed herein that are acceptable to both the Architect and applicable local codes and ordinances.

C. Pipe sizes as shown on the Drawings are minimum pipe sizes. Contractor shall increase those pipe sizes if calculations so require, but under no circumstance shall pipe sizes be decreased.

1.05 SUBMITTALS

A. Prior to submittal to Architect, submit shop drawings, product data, and hydraulic calculations to local Fire Marshal and Owner's Insurance.

B. After approval from local Fire Marshal and Owner's Insurance Underwriter, submit shop drawings, product data, and hydraulic calculations to Architect (with Certificate of Approval from local Fire Marshal and Owner's Insurance Underwriter for approval in accordance with Division 01 and Section 21 00 10.

C. Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals.

D. Indicate valve data and ratings.

E. Submit certificates as listed below to Architect in accordance with Division 01 and Section 21 00 10.

1. Test Certificate of Approval for Piping System.

PART 2 - PRODUCTS

2.01 PIPE, FITTINGS, AND VALVES

A. Provide above floor pipe, fittings, valves in accordance with City codes and ordinances, NFPA 13 for sprinkler and Owner's Insurance.

B. The minimum thin wall piping allowed shall be schedule 40 for pipe up to 2 in. and Schedule 10 for pipe over 2 in. All thin wall piping shall be joined using rolled grooves with coupling.

C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction and expansion; “C” shape composition sealing gasket; steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.

1. Acceptable Manufacturers:
    a. Victaulic
    b. Tyco (Grinnell Mechanical Products)
    c. Gruvlok (Anvil International)

D. For all threaded pipe, use Schedule 40.

E. Piping for all dry pipe sprinkler systems and all dry standpipes shall be galvanized.

F. Within 5 ft. 0 in. of the building provide ductile iron pipe (AWWA C151) for below ground installation. Fittings shall be ductile iron, 250 pound rated, flanged joint (AWWA C110). Joints shall be flanged with full-face 1/16-in. thick red rubber gasket. All bolts and nuts shall be 316 stainless steel. Both pipe and fittings shall be tar coated outside and cement-mortar lined inside.

G. All-exterior below ground piping shall be ductile iron pipe (AWWA C151). Fittings shall be ductile iron, 250 pound rated, mechanical joint (AWWA C110). Joints shall be mechanical joint or push-on (AWWA C111). Both pipe and fittings shall be tar coated outside and cement-mortar lined inside (AWWA C104). Beyond 5 ft. 0 in. outside of building provide below ground pipe, fittings and valves in accordance with Civil Site Specifications.

H. Use of one piece In-Building Riser will be acceptable. UL/FM/NSF 61, 300-series stainless steel , provide with end connections compatible with connecting piping material.

I. Use FlexHead flexible sprinkler piping for run-outs to individual heads to center heads in lay-in ceilings.

2.02 EXCAVATION, BACKFILLING AND COMPACTING

A. Provide excavation, backfilling and compacting in accordance with Division 31.

B. Excavation:
   1. Excavate to the depths required or as indicated.
   2. Retain suitable sandy soil for backfilling.
   3. Remove excess and non-suitable material.
   4. Shore as necessary.
   5. Excavate all materials encountered including rock and filled-in material.
   6. Form sides where required.

C. Backfilling:
   1. Do not backfill until all tests are complete and approved.
   2. Backfill bottom of trench in 6 in. layers using sandy fill.
   3. Place pipe on minimum bed of 6 in. sand.
   4. Backfill around pipe and minimum of 12 in. above pipe with sand.

D. Compaction:
   1. Compact backfill to 95% maximum density for cohesionless soils.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends to full inside diameter.

B. Remove burrs and bevel plain end ferrous pipe.

C. Remove scale and foreign material, inside and outside, before assembly.

3.02 INSTALLATION - PIPE

A. Thread steel pipe joints up to and including 1-1/2 in. diameter. Thread, weld, or groove 2-in. diameter and larger, including branch connections.

B. Mechanical joints may be used instead of threaded or welded joints.

C. Die-cut threaded joints with full-cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

D. Coat threaded ends with pipe lubricant compound.

E. In steel piping, main sized saddle branch connections or direct connection of branch lines to mains is permitted if main is two pipe sizes larger than the branch. Do not project branch pipes inside the main pipe.

F. Solder or braze copper tubes.

G. Install piping in accordance with NFPA 13, for sprinkler systems and NFPA 24 for private fire service mains and their appurtenances.

H. Do not penetrate or cut building structural members.

I. Provide sleeves when penetrating floors and walls.

J. Seal pipe and sleeve penetration to achieve fire and smoke resistance equivalent to fire and smoke separation.

K. Fire protection water service piping below building shall be provided with both flanged joints and thrust block restraint in accordance with NFPA 24. Flange bolts and nuts shall be stainless steel. Thrust block restraint shall be provided on the below floor elbow at the base of the riser. Area of bearing face of concrete thrust block shall be a minimum of 3.2 square feet.

L. Establish elevation of buried pipe outside the building to ensure not less than 3 ft. of cover over top of pipe.

M. Piping shall not run through grade beams. Piping shall run under grade beams.

3.03 INSTALLATION - VALVES

A. Install valves with stems upright or horizontal, not inverted.

B. Provide drain valves at main shut-off valve and after all zone valves. In addition, provide auxiliary drains at all low points.

C. Adjust all pressure reducing valves to minimum pressures within the operating pressure range as required by NFPA 13. Fire Department valve outlet shall not exceed 150 psig. Automatic sprinkler systems shall not exceed 100 psig.

3.04 CLEANING

A. Flush entire piping system of foreign matter in accordance with NFPA 13 and NFPA 24.

3.05 TESTING

A. Hydrostatically test entire system in accordance with local Fire Marshal, Owner's Insurance Underwriter, NFPA 13, and NFPA 24 or 1-1/2 times the operating pressure, whichever is greater.

B. Test results shall be witnessed and approved by local Fire Marshal, Owner's Insurance Underwriter, and Architect.

C. Submit Test Certificate of Approval for Piping System stating that all test results are satisfactory. Certificate of Approval must be signed by Contractor, local Fire Marshal, Owner's Insurance Underwriter, and Architect.

END OF SECTION

SECTION 21 13 00
AUTOMATIC SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of Automatic Sprinkler Fire Extinguishing System Work required by this section is indicated on Drawings and by requirements of this section.

B. This section includes design and provisions of an Automatic Sprinkler Fire Extinguishing System. Types of Fire Extinguishing Automatic Sprinkler Systems specified in this section include the following:

1. Wet Pipe System

1.02 REFERENCES

A. NFPA 13 - Installation of Sprinkler Systems, latest edition.

B. NFPA 24 - Installation of Private Fire Service Mains and Their Appurtenances, latest edition.

1.03 DESIGN CRITERIA

A. System to provide coverage for entire building.

B. Interface system with building fire and smoke alarm system.

C. Design systems to the occupancy requirements of NFPA 13, City Codes and Ordinances, and the Owner's Insurance Underwriter.

D. Provide Fire Department connection.

E. Provide detailed shop drawings of the automatic sprinkler systems in accordance with NFPA 13.

F. Provide hydraulic calculations of the automatic sprinkler systems in accordance with NFPA 13. Hydraulic calculations shall not exceed 90% of the available pressure.

1.04 QUALITY ASSURANCE

A. Conformance with applicable state and local codes and ordinances.

B. Equipment and Components: Bear UL label or marking.

C. Specialist Firm: Company specializing in sprinkler systems design and installation, Licensed Fire Protection Contractor by the Texas State Board of Insurance Underwriters with minimum three years' experience.

1.05 REGULATORY REQUIREMENTS

A. Design and install in accordance with NFPA 13, City Codes and Ordinances and the requirements of Owner's Insurance Underwriter.

B. Pipe sizes as shown on the Drawings are minimum pipe sizes. Contractor shall increase those pipe sizes if calculations so require at no additional cost, but under no circumstance shall pipe sizes be decreased.

1.06 SUBMITTALS

A. Prior to submittal to Architect submit shop drawings, product data, and hydraulic calculations to local Fire Marshal and Owner's Insurance Underwriter.

B. After approval from local Fire Marshal and Owner's Insurance Underwriter submit shop drawings, product data and hydraulic calculations to Architect (with Certificate of Approval from local Fire Marshal and Owner's Insurance Underwriter) for approval in accordance with Division 01 and Section 21 00 10.

C. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories.

D. Submit certificates as listed below to Architect in accordance with Division 01 and Section 21 00 10.

1. Test Certificate of Approval for equipment and system operation.

1.07 PROJECT RECORD DOCUMENTS

A. Submit documents in accordance with Division 01 and Section21 00 10 .

1.08 OPERATION AND MAINTENANCE DATA

A. Submit manufacturer's operation and maintenance data under provisions of Division 01 and Section 21 00 10.

B. Include written maintenance data on components of system, servicing requirements, and Record Drawings.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store equipment in shipping containers with labeling in place under provisions of Division 01 and Section 21 00 10.

1.10 EXTRA STOCK

A. Provide extra sprinkler heads under provisions of NFPA 13.

B. Provide suitable wrenches for each head type.

C. Provide metal storage sprinkler head and wrench cabinet in location designated.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. See Section 21 00 10.

2.02 ALARM CHECK VALVE

A. Alarm Check Valve: Automatic flow detector with alarm circuits, pressure switch, retard chamber, and electric alarm bell .

2.03 SPRINKLER HEADS

A. Suspended Ceiling Type:

1. Semi-recessed "Standard" pendent type with chrome-plated finish and matching escutcheon.
2. Fully recessed pendent type with white cover plate.
3. Semi-recessed commercial/residential "Quick Response" vandal resistant pendent type with chrome-plated finish and matching escutcheon for all sleeping rooms equal to Reliable ZX-QR-INST pendent or sidewall.
4. In all electrical and mechanical rooms provide high temperature rated at 286°F pendant type sprinkler heads with sprinkler head guards.
5. The use of o-ring sealed sprinkler heads is prohibited.

B. Hard Ceiling Type: Fully recessed pendent type with white cover plate.

C. Exposed Area Type: Standard upright types with chrome finish.

D. Fusible Link: Temperature rated for specific area hazard.

E. Guards: Finish to match sprinkler head.

2.04 ELECTRIC SWITCHES

A. Alarm switch:

1. Vane type, 24 VDC, adjustable retard (wet system only).
2. Pressure Type, Snap Action, NEMA 4 construction, 5 psi to 15-psi adjustment range, 24 VDC (dry system only). Designed to activate alarm on increase in pressure.

B. Supervisory switch:

1. OS&Y gate valve type, 24 VDC.
2. Pressure switch: 24 VDC.

2.05 ALARM BELL

A. Exterior Alarm Bell: Electric 10 in. diameter, weatherproof, 97 dB at 10 ft. 0 in., 24 VDC, marked "Sprinkler Alarm."

B. Interior Alarm Bell: Electric 6 in. diameter, 93 dB at 10 ft. 0 in., 24 VDC, marked sprinkler alarm.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate Work of this Section with other affected work.

3.02 INSTALLATION

A. Installation shall be in accordance with NFPA 13.

B. Locate fire department connection in accordance with City requirements with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of Fire Department wrench handles.

C. Locate exterior alarm bell on outside building wall next to riser. Locate interior alarm bell on inside building wall next to riser.

D. Place pipe runs to minimize obstruction to other work.

E. Place piping in concealed spaces above finished ceilings.

F. Center heads two directions in 2 ft. 0 in. x 2 ft. 0 in. ceiling tile and provide piping offsets as required.

G. Apply strippable tape or paper cover to ensure sprinkler heads do not receive field paint finish.

H. Provide excavation, bedding, backfilling and compaction in accordance with Division 31 for work in this section.

I. Installation of preaction system and accessories shall be in accordance with manufacturer's recommendations.

J. Provide 3/4-in. ball drip at low point of fire department connection and pipe to floor drain or through exterior wall.

K. Provide 24 in. x 24 in. x 6 in. thick reinforced concrete collar around base of sidewalk fire department connection.

L. All sprinkler heads in gymnasiums, other activity areas, or any other areas where sprinkler head may be susceptible to damage by building occupants shall be protected with wire guards.

M. Sprinkler heads located under glass or plastic skylights exposed to direct rays of sun shall be intermediate temperature classification.

N. All interconnecting power, control, and alarm wiring between preaction battery charger/power supply and all system components shall be by Fire Protection Contractor. Electrical Contractor shall provide power supply to battery charger/power supply unit and provide connected supervisory and alarm circuits.

O. Dry and preaction sprinkler systems located in areas with ceilings shall be concealed with dry pendant type sprinkler heads.

3.03 SYSTEM TESTS

A. Test wet pipe system, alarm switches, supervisory switches, electric alarm bells, and interfacing with building fire and smoke alarm system to ensure proper operation. Tests shall be performed in accordance with the City Fire Marshal, Factory Mutual, and NFPA 13.

B. Tests shall be witnessed and approved by local Fire Marshal.

C. After completion and approval of testing submit "Test Certificate of Approval" for preaction system, alarm switches, supervisory switches, and electric alarm bells stating that all test results are satisfactory. Certificate of Approval must be signed by Contractor.

3.04 DEMONSTRATION OF SYSTEM AND EQUIPMENT

A. Prior to final acceptance, Contractor and Manufacturer’s Representative shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of the preaction sprinkler system including associated accessories and controls.

B. Prior to final acceptance, Contractor shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of the wet pipe automatic sprinkler system including associated accessories and controls.

C. After completion and approval of demonstrations, submit "Demonstration Certificates of Completion" for wet pipe automatic sprinkler system including all associated accessories and controls stating that the Demonstrations of the systems are satisfactory. Certificates must be signed by the Manufacturer's Representative, Contractor, Owner, Architect, and Engineer.

END OF SECTION

SECTION 22 00 10
BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS AND SUPPLEMENTAL GENERAL PROVISIONS

A. The "General Conditions" and "Supplementary Conditions" are by reference made a part of this section and shall apply to each and every heading as though included herein.

B. In the event of conflict, the requirements of the "General Conditions" and "Supplementary Conditions" will take precedence over these "General Requirements".

1.02 GENERAL

A. The Contractor shall provide all plans, labor, equipment, appliances and materials, and shall perform all operations in connection with the installation of the plumbing work in accordance with the Specifications, applicable drawings, and the conditions specified above.

B. Contractor shall provide all equipment required and usually furnished in connection with such work and systems whether or not specifically mentioned or specifically indicated on the drawings.

C. Per the 2021 IECC the Mechanical System and Service Hot Water System Commissioning is not required when cooling equipment capacity is less than 480,000 Btuh (40 Tons) and the combined Space Heating and Service Hot Water System heating capacity is less than 600,000 Btuh (50 Tons).

1.03 COMMISSIONING

A. The Contractor shall provide all system commissioning services as required by section C408 of the applicable edition of the International Energy Conservation Code (IECC). Plumbing systems shall comply with IECC section C403.

B. Commissioning, as outlined in IECC section C408 shall include the following:

1. A commissioning plan.
2. Water heater(s).
3. Hot water systems balancing.
4. Functional performance testing for all plumbing equipment and controls.
5. A preliminary commissioning report.
6. Final documentation including drawings, O&M manual(s), T&B report, and final commissioning report.

1.04 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize theirself with the existing work conditions, hazards, grades, actual formations, soil conditions, and local requirements. The submission of bids shall be deemed evidence of such visits.

B. 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.

C. The trade furnishing the equipment shall be responsible for notifying the Contractor prior to ordering it, in the event that equipment specified and/or reviewed is incompatible with this requirement.

1.05 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

A. Refer to other sections of the specifications for construction phasing and time increments.

B. The Contractor shall obtain and pay for all required utility connections, impact fees, utility extensions and/or relocations and shall pay all costs and inspection fees for all work included herein.

1.06 APPLICABLE CODES AND STANDARDS

A. The installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of the Specifications, except as may be hereinafter modified in these Specifications and associated drawings.

B. Latest edition of the National Fire Protection Association Standards (NFPA):
   1. NFPA No. 70 National Electrical Code
   2. NFPA No. 101 Safety to Life from Fire in Buildings and Structures
   3. NFPA No. 255 Test of Surface Burning Characteristics of Building Materials

C. United States of America Standards Institute (ASA) Standards:
   1. A40.8 National Plumbing Code
   2. B31.1 & B31.1a Code for Pressure Piping

D. American Society of Mechanical Engineers (ASME): Boiler and Pressure Vessel Codes.

E. American Society of Testing and Material (ASTM): All applicable manuals and standards.

F. American Water Works Association (AWWA): All applicable manuals and standards.

G. National Electrical Manufacturer's Association (NEMA): All applicable manuals and standards.

H. City and State Building Codes.

I. State of Texas Occupational Safety Act: Applicable safety standards.

J. Occupational Safety and Health Act (OSHA).

K. State of Texas Energy Conservation Construction Code.

L. All work shall be in accordance with all regulations and requirements of the State of Texas Architectural Barriers Act (TAS) and the Americans with Disabilities Act (ADA).

M. Refer to Specifications sections hereinafter bound for additional codes and standards.

N. All materials and workmanship shall comply with all applicable state and national codes, specifications, and industry standards. All material shall be listed by the Underwriter's Laboratories, Inc., as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.

O. All equipment provided and all installation methods shall meet all applicable requirements of the International Energy Conservation Code.

P. The Contract Documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by other specifications of the Contract Documents, providing no work or fabrication of materials has been accomplished in a manner of non-compliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

1.07 CONTRACT DOCUMENTS

A. These specifications are accompanied by drawings of the building and details of the installations indicating the locations of equipment, piping, ductwork, outlets, switch controls, circuits, lines, etc. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.

B. If the Contractor deems any departures from the drawings necessary, details of such departures and the reasons therefore shall be submitted to the Architect for review. No departures shall be made without prior written acceptance.

C. There are intricacies of construction that are impractical to specify or indicate in detail; however, in such cases the current rules of good practice and applicable specifications shall govern.

D. It is the Contractor's responsibility to properly use all information found on the Civil, Architectural, Structural, Fire Protection, Plumbing, Mechanical and Electrical drawings where such information affects their work.

E. All dimensional information related to new structures should be taken from the appropriate drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.

F. The interrelation of the specifications, the drawings, and the schedules is as follows: The specifications determine the nature and setting of the several materials, the drawings establish the quantities, dimensions and details, and the schedules give the performance characteristics.

G. Should the drawings or specifications disagree within themselves, or with each other, the better quality of greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Architect in writing, shall be performed or furnished. Figures indicated on drawings govern scale measurements and large-scale details govern small-scale drawings.

1.08 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of fire protection, plumbing, mechanical, and electrical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared to indicate a suitable arrangement.

B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

C. Maintain all Code required clearances for equipment access.

1.09 FABRICATION DRAWINGS

A. Contractor shall submit piping shop drawings for review by the Architect. Fabrication drawings shall be fully coordinated with ALL other trades and with existing conditions.

B. All required shop drawings, except as hereinafter specified, shall be prepared at a scale of not less than 1/8 in. equal to 1 ft. for floor plans and 1/4 in. equal to 1 ft. for mechanical rooms.

1.10 SUPERVISION

A. Each contractor shall keep a competent superintendent or foreman on the job at all times necessary for the timely and proper completion of the work.

B. It shall be the responsibility of each superintendent to study all drawings and familiarize themselves with the work to be done by other trades. They shall coordinate this work with other trades, and before material is fabricated or installed, make sure that their work will not cause an interference that cannot be resolved without major changes to the drawings. If a conflict between trades arises that cannot be resolved at the jobsite, the matter shall be referred to the Architect for their ruling.

1.11 EXISTING FACILITIES

A. The Contractor shall be responsible for loss or damage to the existing facilities caused by themself and their workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all plumbing, heating, air conditioning, and ventilating services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, and remove all such temporary protection upon completion of the work. All barricades and safety devices shall be in compliance with OSHA.

B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, all Contractors shall remove and reinstall, in locations approved by the Architect, all devices required for the operation of the various systems installed in the existing construction. This is to include, but is not limited to, temperature control system devices, electrical switches, relays, fixtures, piping, conduit, etc.

E. Outages of services, as required by the new installation, will be permitted only at a time approved by the Architect.

1.12 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition.

B. All items that are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed and sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Architect. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas of facilities, which must remain in operation during the construction period, shall not be interrupted without prior specific approval of the Architect as hereinbefore specified.

D. All equipment and materials indicated to be removed and not be re-used shall be disposed of by the Contractor. Coordinate with Owner where materials are to be stored.

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall prepare, in triplicate for the Owner's Manual, complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc., for each item of equipment. Include copies of all equipment warranties.

B. In addition, the Contractor shall provide the services of a competent engineer or a technician acceptable to the Architect to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of not less than 4 hours to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, stating the dates of instruction and the personnel to whom instructions were given. The Contractor shall be responsible for proper maintenance until the instructions have been given to the Owner's maintenance personnel.

1.14 GUARANTEE

A. All work and equipment shall be guaranteed for a period of one year from the date of substantial completion.

B. Guarantee shall be for all labor and materials.

C. Certain items for equipment shall have additional or extended warranties when so specified.

1.15 MATERIALS AND WORKMANSHIP

A. All materials, unless otherwise specified, shall be of current U.S. manufacture, new, free from all defects, and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall present a neat, workmanlike appearance. Materials, and/or equipment damaged in shipment, or otherwise damaged prior to installation, shall not be repaired at the job site, but shall be replaced with new materials and/or equipment.

B. The responsibility for furnishing the proper equipment and/or material, and to see that it is installed as intended by the manufacturer rests entirely upon the Contractor, who shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

1.16 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials and adhesives incorporated in this project shall conform to NFPA 255, latest edition. The classification shall not exceed No. 2, with the range of indices between 0 to 25 for these Classifications as listed in the Federal Specifications. Modifications shall be made to insulating materials, etc., as required to comply with the Federal Specification.

1.17 LARGE APPARATUS

A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

1.18 FLOOR AND CEILING PLATES

A. Except as otherwise noted, provide chrome plated brass floor and ceiling plates around all pipes, conduits, ducts, etc., passing exposed through walls, floors, or ceilings, in any spaces, except under floor and attic spaces. Plates shall be sized to fit snugly against the outside of the pipe or against the insulation on lines that are insulated and positively secured to such pipe or insulation. Plates will not be required for piping where pipe sleeves extend 3/4 in. above finished floor. All equipment rooms are classified as finished areas. Round and rectangular ducts shall have plates made to fit accurately at all floor, wall and ceiling penetrations.

1.19 SLEEVES, INSERTS AND FASTENINGS

A. Proper openings through floors, walls, roofs, etc., for the passage of piping, ductwork, etc., shall be provided. All penetrations must pass through sleeves except soil pipe installed under concrete slabs on fill. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Architect.

B. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.

C. The minimum clearance between horizontal penetrations including insulation where applicable, and sleeves shall be 1/4 in., except that the minimum clearance shall be 2 in. where piping contacts the ground. Sleeves through walls and partitions shall be installed flush with exposed surfaces. Sleeves through floors shall be extended 2 in. above finished floor.

D. Above grade and dry location sleeves shall be constructed from 20 to 22 gauge galvanized steel. Sleeves passing through walls or floors on or below grade and/or moist areas such as mechanical rooms shall be constructed of galvanized steel Schedule 40 pipe and shall be designed with suitable flange in the center of the floor or wall to form a waterproof passage. After the pipes have been installed in the sleeves, void space around the pipe shall be sealed with "Link-Seal" modular wall and casing seals as manufactured by Thunderline Corporation.

E. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction.

F. Fastening of pipes, conduits, etc., in the building shall be as follows: To wood members - by wood screws; to masonry - by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry; to steel - machine screws or welding (when specifically permitted or directed), or bolts, and to concrete by suitable inserts anchored to reinforcing steel, and poured in place unless other means are acceptable for general use, and will only be permitted where specifically acceptable to the Architect.

G. Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.

H. Vermin Proofing: The open space around all ductwork, piping, etc., passing through the ground floor and/or exterior walls shall be sealed with a continuous bead of sealant.

I. The space around piping, ductwork, etc., penetrating walls, ceilings and floors that define air plenums shall be sealed airtight in an acceptable manner. Ceiling plenums used for return air are considered air plenums.

1.20 ACCESS DOORS

A. This Contractor shall provide wall or ceiling access doors for unrestricted access to all concealed shutoff or service valves, strainers, unions, flow switches, pressure reducing valves, control valves, air terminal units, fire and/or smoke dampers, and other items of concealed mechanical equipment. All access door locations are not shown on the drawings. It is the Contractor's responsibility to provide access doors at all locations required.

B. Access doors mounted in painted surfaces shall be equal to Milcor (Inland-Ryerson Construction Products Company) manufacture, Style K for plastered surfaces and Style M or DW for non-plastered surfaces. The Style K doors shall be set so that the finished surface of the door is even with the finished surfaces of the adjacent finishes. Access doors mounted on tile surfaces shall be stainless steel materials. Access doors shall be minimum of 18 in. x 18 in. in size.

1.21 CONSTRUCTION REQUIREMENTS

A. The Civil, Architectural, Structural, Fire Protection, Mechanical, Plumbing, and Electrical plans and specifications including the General Provisions, Supplemental General Provisions, and other pertinent documents issued by the Architect, are a part of these specifications and the accompanying fire protection drawings, and shall be complied with in every respect. All the above is included in the Contract Documents, and shall be examined by all bidders. Failure to comply shall not relieve the Contractor of responsibility or be used as a basis for additional compensation due to omission of architectural, structural and electrical details from the plumbing drawings.

B. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems or required to complete the installation, whether mentioned or not.

C. The Contractor shall be responsible for fitting their material and apparatus into the building and shall carefully lay out their work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation supplied by the manufacturer of the equipment to be installed and thereby to provide an integrated satisfactory operating installation.

D. The plumbing and associated drawings are necessarily diagrammatic in character and cannot show every connection in detail or every pipe or equipment in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate pipe hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc., shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

E. When the plumbing drawings do not give exact details as to the elevation of pipe, ducts, etc., physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Piping and duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner, and the plans do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas. Piping specified to be insulated shall be supported in a manner that will allow the insulation to be installed without gaps. Insulated piping in concealed areas shall be offset with fittings as necessary to permit installation of insulation. Bending of pipes or installing pipes in a strain in order to insulate will not be permitted.

F. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Equipment shall be so located and installed as to permit convenient and safe maintenance and future replacement. Piping, ductwork, valve stems, etc., shall not block service space.

1.22 PLUMBING SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary) and Division 01 Section: "SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES" for submittal definitions, requirements, and procedures.

B. Submittal of Shop Drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from Subcontractors and material suppliers directly to the Architect will not be processed.

C. Submit Shop Drawings, product data, and samples on items indicated in the individual sections.

D. Shop Drawings and submittal data shall not be used as requests or proposals for alternate equipment or materials. Refer to Item "Product Options and Substitutions" elsewhere in this section.

E. THIRD PARTY CERTIFICATION: All Packaged equipment shall be independently Third Party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399, as well as NFPA Pamphlet #70, National Electric Code (NEC), Article 90-7.

1.23 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and the Division 01 Section "SUBSTITUTION PROCEDURES" for requirements in selecting products and requesting substitutions.

B. Standards for Materials:

1. These specifications indicate a standard for all materials incorporated into the work, with manufacturer's names and catalog numbers used to establish a grade and quality of materials and equipment. The manufacturer listed on the equipment schedules, or named first in the specifications, is the one on whose equipment the layout is based. Other named manufacturers must meet the indicated performance and space requirements.
2. The "approved equal" clause used in these specifications is to permit the proposal of unnamed manufacturer's products for the work, and the Architect/Engineer's decision concerning equal products is final.
3. Considerations as to determination of equal products include, but are not limited to, the following:

Materials	Physical size
Workmanship	Weight
Gauges of Materials	Appearance
Available Local Service Personnel	Performance
Previous successful installations	Capacity
Delivery Schedules	Required Equipment Clearances

C. Requests for substitutions for equipment, materials and apparatus listed in Division 22 Sections must be submitted in writing a **MINIMUM OF 10 DAYS** prior to the scheduled bid date. Such requests must be accompanied by complete data to permit proper evaluation.

D. BIDS SHALL NOT BE BASED ON UN-APPROVED MATERIALS, EQUIPMENT, OR APPARATUS. UNAPPROVED MATERIAL, EQUIPMENT OR APPARATUS WILL NOT BE ACCEPTED.

E. Should electrical, water, drain, natural gas, structural support, or other similar requirements for alternate equipment, whether named in the specifications or approved as a substitution, be different from requirements for the products used in laying out the project, such changes shall be the responsibility of the Contractor, and shall not result in extra charges to the Owner or Architect/Engineer.

1.24 RECORD DOCUMENTS

A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for requirements. The following paragraphs supplement the requirements of Division 01.

B. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned for column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.

C. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

1.25 PAINTING

A. Field painting of plumbing equipment, piping systems, etc., shall be accomplished under Division 09 of these specifications.

B. Protection of Factory-applied Finishes:
1. Factory-applied finishes on equipment and apparatus installed on the project shall be carefully protected.

2. At the conclusion of the work, and prior to final acceptance of the project, equipment and apparatus shall be thoroughly cleaned of all construction dirt, oil and grease smears, temporary labels, debris, paint droppings, etc.
3. Damaged factory finishes shall be restored to their original condition using procedures, materials and application techniques as set forth in Division 09 found elsewhere in these specifications.

1.26 CLEANING

A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for general requirements for final cleaning.
B. Refer to Division 23 Section: "MECHANICAL TESTING, ADJUSTING, AND BALANCING" for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.
C. Name Plates:
   1. All nameplates shall be protected from damage during the construction process.
   2. At the conclusion of the work, the nameplates shall be carefully cleaned and left in a fully legible condition.
D. Removal of Rubbish: Each Contractor is responsible for the timely removal of rubbish and trash generated by their work, such as empty cartons, containers, materials crates, etc. Particular attention is called to residue that may present a potential tripping or injury hazard.

1.27 MOTORS AND DRIVES

A. Motors:
   1. General: Motors shall be U/L-approved, with copper windings, and with a minimum Service Factor of 1.15. The nominal capacity shall exceed the brake horse-power requirements at duty schedules.
   2. Motors 1/2 HP and smaller shall be 120-volt, single-phase with internal overload protection.
   3. Motors 3/4 HP and larger shall be 208/230 or 460 -volt, 3-phase, unless scheduled or noted otherwise, and shall have thermal over-load cutouts in each phase as recommended by the motor manufacturer.
   4. Motors shall be as manufactured by Century, General Electric, US Motors, Wagner, Westinghouse, or approved equal.
B. Drives:
   1. Belts drives shall be rated for 150% of motor-rated horsepower.
   2. Drive assemblies up to two (2) belts shall have adjustable motor sheaves with the mid-point of the adjustment range at the RPM required for the specified performance.
   3. On drive assemblies with 3 or more belts, provide fixed motor sheaves for the specified RPM. Provide and install up to 2 pulley changes as necessary to achieve the required air quantities.
   4. All multiple-belt drives shall be factory-marked-matched sets.
C. Specific requirements:
   1. Provide high-efficiency motors for the following:
      a. Pumps, as scheduled.
   2. Efficiency ranges shall be as follows:

Nominal HP	Minimum Efficiency	Premium Efficiency
3	86.5	89.5
5	87.5	89.5
7.5	88.5	91.7
10	89.5	91.7
15	91.0	92.4

20	91.0	93.0
25	91.7	93.6
30	92.4	93.6
40	93.0	94.1
50, 60, 75	93.0, 93.6, 94.1	94.5, 95.0, 95.4
100	94.1	95.4

3. Motor efficiency certification shall be included with Product Submittal Data in accordance with Division 01 of these specifications.
4. Variable Speed (Frequency) AC Drives:
    a. Where scheduled on the plans, provide and install variable speed (frequency) AC drives for motors.
    b. Variable speed (frequency) AC drives shall be as described in Section238965 - MOTOR CONTROLLERS - of these Specifications.
5. Motor Starters and Controllers:
    a. Motor starters and controllers for fans, pumps, air-handling units, compressors, etc., which are not provided as an integral part of a factory-assembled package, shall be provided under Division 23 of the specifications. Refer to Section 238965 "MOTOR CONTROLLERS."

PART 2 - PRODUCTS

2.01 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer's materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect's instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such instructions from the Architect, he shall bear all costs arising in connection with the deficiencies.

B. The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage.

C. Capacities shall be not less than those indicated but shall be such that no component or system becomes inoperative or is damaged because of start-up or other overload conditions.

D. Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriter's Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers, the Contractor shall submit proof that the items furnished under these sections of the specifications conform to such requirements. The ASME stamp will be acceptable as sufficient evidence that the items conform to the respective requirements.

E. Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Observation.

F. Standard factory finish will be acceptable on equipment specified by model number; otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking, and no signs of rust creepage beyond 1/8 in. on either side of the scratch mark. Where rust-inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable, unless a specific coating is specified, except that coal tar or asphalt type coatings will not be acceptable, unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-6215.

G. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

H. The Contractor shall be responsible for the coordination and proper relation of their work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize themself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Architect of any discrepancy before performing any work. Adjustments to the work required, in order to facilitate a coordinated installation, shall be made at no additional cost to the Owner.

2.02 PROTECTION

A. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.

B. Take particular care not to damage the building structure in performing work. All finished floors, steel treads, and workmen or their tools and equipment shall cover finished surfaces to prevent any damage during the construction of the building.

C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final observation must be cleaned of rust and repainted as specified elsewhere in these specifications.

2.03 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

A. Each trade, subcontractor and/or contractor must work in harmony with the various other trades, subcontractors, and/or contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or contractor must pursue their work promptly and carefully as not to delay the general progress of the job. This Contractor shall work in harmony with contractors working under other contracts on the premises.

2.04 PRECEDENCE OF MATERIALS

A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the available space, and which will insure complete and satisfactory systems. Each Contractor shall be responsible for the proper fitting of thier material and apparatus into the building.

B. Each Contractor shall so harmonize their work with that of the other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines that require a stated grade for proper operation. Where space requirements conflict, the following order of precedence shall, in general, be observed:
   1. Building lines
   2. Structural members
   3. Drain piping
   4. Vent piping
   5. Steam piping
   6. Condensate piping
   7. Refrigerant piping
   8. Electrical bus duct
   9. Supply ductwork
   10. Return ductwork
   11. Exhaust ductwork
   12. Chilled water and heating water piping
   13. Automatic Fire Protection Sprinkler Piping
   14. Natural gas piping
   15. Domestic hot and cold water piping
   16. Electrical conduit

2.05 LOCATION OF OUTLETS IN ROOMS

A. All fire protection, plumbing, acoustical tile, diffusers, grilles, registers, and other devices shall be referenced to coordinated, established data points and shall be located to present symmetrical arrangements with these points and to facilitate the proper arrangements of acoustical tile panels and other similar panels with respect to the mechanical and electrical outlets and devices. Those mechanical and electrical outlets shall be referenced to such features as wall and ceiling furrings, balanced border widths, masonry joints, etc. Outlets in acoustical tile shall occur symmetrically in tile joints or in the center of whole tiles. When locations of mechanical and electrical devices shown on the Architect's reflected ceiling plans need to be modified, the final determination of the exact location of each outlet and the arrangement to be followed shall be acceptable to the Architect.

B. The drawings show diagrammatically the location of the various outlets and apparatus. Exact locations of these outlets and apparatus shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with the other trades. The Architect reserves the right to make any reasonable change in location of any outlet or apparatus before installation, without additional cost to the Owner.

C. The Contractor, by submitting a bid on this work, sets forth that he has the necessary technical training and ability, and that he will install their work in a satisfactory and workmanlike manner which is up to the best standards of the trade, complete, and in good working order. If any of the requirements of the drawings and specifications are impossible of performance, or if the installation, when made in accordance with such requirements, will not perform satisfactorily, he shall report it to the Architect for correction promptly after discovery of the discrepancy.

2.06 CONNECTIONS FOR OTHERS

A. This Contractor shall rough-in for and make all gas, water, steam, sewer, etc., connections to all fixtures, equipment, machinery, etc., provided by others in accordance with detailed roughing-in drawings provided by the equipment suppliers, along with actual measurements of the equipment connections, or as detailed.

B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, etc.

C. Provide all air gap fittings where required. In each water line serving an item of equipment or piece of machinery, provide a shut-off valve. On each drain not provided with a trap, provide a suitable trap.

D. All pipe fittings, valves, traps, etc., exposed in finished areas and connected to chrome-plated lines provided by others shall be chrome plated to match.

2.07 WALL HUNG CARRIERS

A. Provide floor mounted carriers for all wall mounted fixtures. Refer to Architectural plans and confirm walls intended to conceal carriers are adequate in depth to provide necessary space and clearance to properly install the carriers.

PART 3 - INSTALLATION

3.01 INSTALLATION METHODS

A. All pipes shall be concealed in pipe chases, walls, furred spaces, or above the ceiling, unless otherwise indicated.

B. Piping may be run exposed in mechanical rooms, janitors' closets, or storage spaces, but only where necessary. All exposed piping shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines.

C. All piping shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.

D. Where limited space is available above the ceilings and below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, in a manner to provide maximum above-floor clearance. Sleeves shall be as specified or as required.

E. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes and conduits run, exposed in machinery and equipment rooms, shall be installed parallel to the building plans, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.

F. There shall be no pipe joints nearer than 12 in. to a wall, ceiling, or floor penetration, unless pipe joint is the welded type joint.

G. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur, the Contractor shall meet with all involved trades and the Architect and resolve the conflict, prior to erection of any work, in the area involved.

3.02 CUTTING AND PATCHING

A. Cut and patch openings through walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction.

B. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills at locations acceptable to the Architect. Impact-type equipment will not be used, except where specifically acceptable to the Architect. Openings in Precast concrete slabs for pipes, conduits, outlet boxes, etc., shall be core drilled or cast to exact size.

C. All openings shall be restored to "as-new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.

D. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect.

E. All plumbing work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

F. No cutting, boring, or excavating, which will weaken the structure, shall be undertaken. NO STRUCTURAL MEMBER MAY BE CUT WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECT.

3.03 ROOF PENETRATIONS

A. Pipe and duct sleeves and flashings compatible with the roofing installation shall be provided for roof penetrations. Manufacturer of roofing materials shall approve methods and materials.
   1. Pitch pans are not acceptable.

B. Roof penetrations through metal roofs by the Plumbing or Mechanical Contractor will be required to have written approval by the Roofing Contractor.

C. Piping penetration flashings shall be specially made for metal roofs and shall be EPDM or neoprene compression molded rubber with corrosion resistant metal base. Flashings shall be by Portals Plus, Inc., Buildex Dektite, or approved equal.

3.04 ROOF PIPING SUPPORTS

A. Single run pipe 2-1/2 in. O.D. and less, shall have Type SS8-C or SS-8R as manufactured by PHP Systems/Design, or an approved equal, spaced at a maximum 8 ft. o.c. and installed on roof pads if required by Roofing Manufacturer. Use roller support for all straight piping lengths of 50 ft. or greater. All piping on fixed support shall be strapped to support channel. Coordinate exact locations of supports with Roofing Contractor. Do not use wood blocking under supports.

B. Multiple parallel runs, or piping larger than 2-1/2 in. O.D. shall have Type PS-1-2, PSE-2-2, or PSE Custom as manufactured by PHP Systems/Design, spaced at a maximum 8 in. o.c. and installed on roof pads if required by Roofing Manufacturer. Use roller support for all straight piping lengths of 50 ft. or greater. Coordinate exact locations of supports with Roofing Contractor. Do not use wood blocking under supports.

3.05 FABRICATION OF PIPE

A. All the various piping systems shall be made up straight and true and run at proper grades to permit proper flow of the contained material. Lines shall also be graded for proper drainage.

B. Piping shall follow as closely as possible the routes shown on plans, but shall take into consideration conditions to be met at the site.

C. Should any unforeseen conditions arise, lines shall be changed or rerouted as required after approval has been obtained.

D. All piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping, in connections, and in equipment to which lines are connected.

E. All piping shall be clean when it is installed. Before installation it shall be checked, upended, swabbed, if necessary, and all rust or dirt from storage shall be removed. Pipe shall not be permitted to lie on the ground during storage. Pipe ends shall be sealed during storage.

3.06 IDENTIFICATION AND LABELING

A. The Contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, valves, piping, etc., by marking them.

B. All items of mechanical and electrical equipment shall be identified by the attachment of engraved nameplates constructed from laminated phenolic plastic, at least 1/16 in. thick, 3-ply, with black surfaces and white core. Engraving shall be condensed gothic, at least 1/2 in. high, appropriately spaced. Nomenclature on the label shall include the name of the item, its mark number, area, space, or equipment served, and other pertinent information. Equipment to be labeled shall include, but not be limited to, the following:

1. Domestic Water Heaters
2. Circulation Pumps
3. Air Compressor
4. Motor controllers
5. Miscellaneous similar and/or related items.

C. The Contractor shall install identification tags to be affixed to those valves that have functions that are not obvious. For example, it would not be expected that valves at a pressure reducing station in a machine room would be tagged. The valve identification tags shall be brass discs, 2 in. in diameter. Each tag shall be attached to its valve with copper clad annealed iron wire or other approved material.

3.07 TESTS AND INSPECTIONS

A. The Contractor shall, during the progress of the work and upon its completion, test their work and make all tests as required by the specifications, state, municipal and other authorities having jurisdiction of the work. Piping pressure tests shall be made before pipe is concealed or covered. Tests shall be made in the presence of authorities requiring tests. The Contractor shall pay all costs, inspection charges and fees required for the tests of their work.

B. The Contractor shall provide all apparatus, temporary piping connection, etc., required for tests. The Contractor shall take all due precautions to prevent damage to the building or its contents incurred by such tests. The Contractor shall repair and make good at their own expense any damage caused by failures or leaks during the tests.

C. Leaks, defects or deficiencies shall be repaired and/or replaced, and tests shall be repeated until the test requirements are complied with fully.

D. All equipment shall be placed in operation and tested for proper automatic control before the final balancing of the system is started.

E. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description, and extent of system tested, test condition, test results, specified results, and any other pertinent data. Data shall be delivered to the Architect.

3.08 COOPERATION AND CLEANUP

A. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of their tools, equipment and materials and shall clean their debris from the job. Upon the completion of the job, each trade shall immediately remove all of their tools, equipment, any surplus materials and all debris caused by their portion of the work.

3.09 CLEANING AND PAINTING

A. All equipment, piping, ductwork, grills, insulation, etc., in finished areas furnished and installed by the Contractor shall be painted. Finished areas include mechanical rooms, boiler rooms, and outside the building as well as occupied areas inside the building. Final painting is to be done by the General Contractor. This Contractor shall thoroughly clean all part of materials and equipment of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.

B. This Contractor shall thoroughly clean the finish on all parts of the materials and equipment with factory applied finishes. Exposed parts in equipment rooms, above crawl space slabs, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. If the finish has been damaged, the Contractor shall re-paint to the satisfaction of the Architect.

C. All canvas finishes shall be painted with one sizing coat if not already sized, containing a mildew resistant additive and Arabol adhesive prior to any other specified finish paint.

D. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during painting operation.

3.10 ELECTRICAL PROVISIONS OF PLUMBING WORK

A. The extent of electrical provisions to be provided as plumbing work is indicated in other sections of the specifications, on the drawings and as further specified in this section.

B. Starters, Controllers: In general, plumbing includes furnishing combination starters. Controllers are specifically included as electrical work when mounted in motor control centers. Electrical work includes installation, mounting and wiring of starters and controllers that are furnished as mechanical work. Free standing, large motor controllers shall be set in place, on pads, as plumbing work.

C. Electrical heating equipment shall be furnished complete with internal or integral fusing and subdivision of loads to comply with the NEC.

D. Wherever possible, match the elements of the electrical provisions of plumbing work with similar elements of the electrical work specified in electrical sections of the specifications.

E. Standards:

1. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards to definitions of terminology herein.
2. Comply with National Electrical Code (NFPA No. 70) for installation requirements.
3. Comply with National Electrical Contractors Association (NECA) "Standard of Installation".

3.11 TEMPORARY FACILITIES

A. Unless noted otherwise in the Supplementary General Conditions; provide temporary facilities.

3.12 EQUIPMENT INSTALLATION REQUIREMENTS

A. All plumbing equipment shall be furnished and installed complete and ready for use.

B. Others shall furnish certain kitchen , lab, or Owner process equipment. Contractor shall be responsible for furnishing and installing all items as required to make equipment complete operating systems. The Contractor shall furnish and install all auxiliary piping, valves, controls, control wiring, conduit, alarms, etc., required. All necessary devices, control wiring, conduit, etc., will not necessarily be shown on the drawings.

3.13 EXCAVATION, BACKFILLING AND COMPACTION

A. Excavation:

1. Excavate to the depths required or as indicated.

2. Retain suitable sandy soil for backfilling.
3. Remove excess and non-suitable material.
4. Shore as necessary.
5. Excavate all materials encountered including rock and filled-in material.
6. Form sides where required.

B. Backfilling:
1. Do not backfill until all tests are complete and approved.
2. Backfill bottom of trench in 6 in. layers using sandy fill.
3. Place pipe on minimum bed of 6 in. sand.
4. Backfill around pipe and minimum of 12 in. above pipe with sand.

C. Compaction:
1. Compact backfill to 95% maximum density for cohesionless soils.

END OF SECTION

SECTION 22 05 06
PLUMBING DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Demolition of:
   1. Plumbing fixtures and trim, specialties, equipment and associated piping.
   2. Fire protection equipment and associated piping.
   3. Hanger and support devices.
   4. All other appliances or devices associated with equipment or devices to be removed.

B. Demolition of all power wiring and conduit from each plumbing item to be removed back to the point of supply.

1.02 QUALITY ASSURANCE

A. Perform all demolition and removal work necessary to arrive at the arrangement shown on the Contract Drawings.

B. Perform all operations in such a method to cause minimum damage to items to be relocated, salvaged, or to remain intact and in use.

1.03 JOB CONDITIONS

A. Perform site repair and removal of salvaged items at times approved by the Owner. Accomplish repair and removal of items in a continuous and diligent manner in order to limit interference with Owner's on-going operations.

B. Drawings may not indicate and specifications may not identify every item required to be moved or removed.

C. Before submitting bids, visit and examine the site of the work and become familiar with the scope of the work and the details of the demolition work to be accomplished.

D. Submittal of a bid will be evidence that such an examination has been made and the various details noted.

E. Claims for extra compensation because of additional labor, materials, or equipment required because of difficulties encountered, will not be recognized unless items were concealed at time of inspection of the Contract Documents. Bring all such items to the attention of the Owner's Representative and the Architect for their disposition before continuing with the work.

F. Execute demolition work in a manner to protect adjacent equipment and other existing items against damage.

G. Provide and erect lights, barricades, warning signs, and other items as required for protection of the Owner's employees, building occupants, and the public.

H. Maintain barricades in good condition throughout the project to substantial completion.

I. Control the dust resulting from demolition to prevent it from spreading the occupied areas of the building and to avoid creating a nuisance in the immediate surrounding area.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PROTECTION

A. Provide protection for all building elements, all items which are to remain, all occupants and all workers at all times, and in accordance with all requirements of the Owner.

3.02 PROTECTION OF BUILDING FROM THE WEATHER

A. Maintain weather protection for the space(s) being worked in at all times, and in accordance with all requirements of the Owner.

3.03 DEMOLITION

A. Perform demolition in accordance with all requirements of the Owner.

3.04 DISPOSITION OF MATERIALS

A. Dispose of all demolition items and materials in a legal off-site location.

3.05 RELOCATION AND REUSE OF PLUMBING ITEMS

A. Relocate items indicated on the Contract Drawings as required to accommodate the new construction. Remove, relocate and reconnect equipment and accessories that are to be reused.

B. Coordinate the work with the Electrical Contractor. Determine which items and equipment are to remain, to be relocated or to be removed. Perform the work consistent with the scope of the project.

C. Transport and store materials removed and designated for relocation as directed by the Owner's Representative.

D. Remove all salvage items not be reused or delivered to the Owner, from the property at the end of each workday.

E. Maintain full water, drain, electrical service, etc., to all equipment and apparatus that remains in service in the building.

3.06 CLEANING

A. Section 22 00 10 "BASIC PLUMBING REQUIREMENTS".

3.07 REMOVAL OF WATER

A. Be responsible for the removal of water in areas in which scheduled work is to be performed.

1. Remove water by pumping, siphoning, absorbent mopping, or compressed air brooming.
2. Do not use any method of removal that will cause damage to new or reused adjacent equipment or materials.

3.08 SCHEDULING

A. Schedule demolition in strict compliance with the Owner's instructions.

3.09 DISCONNECTION AND RECONNECTION OF UTILITIES

A. Do not disconnect or reconnect any utilities until notifying the Owner's Representative.

B. Notify the Electrical Contractor when requiring Electrical Disconnect or Reconnect.

END OF SECTION

SECTION 22 05 12
PLUMBING AND ELECTRICAL COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
B. Refer to Section 21 00 10 - BASIC FIRE PROTECTION REQUIREMENTS.
C. Refer to Section 22 00 10 - BASIC PLUMBING REQUIREMENTS.
D. Refer to Section 23 00 10 - BASIC MECHANICAL REQUIREMENTS.

1.02 SUMMARY

A. This Section describes the coordination between the Fire Protection, Plumbing, Mechanical and Electrical portions of the work.
B. This Section is included under the Division 21 portion of the Specifications as Section 21 05 12, under the Division 22 portion of the Specifications as Section 22 05 12, under the Division 23 portion of the Specifications as Section 23 05 12, and under the Division 26 portion of the Specifications as Section 26 05 12.

1.03 WORK INCLUDED

A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. **T**□□□ schedu □□ may □□□□□□ equ □□ment and systems t □at are not r □quired for this pro □ect **O**□□□ the equipment and systems □hat are □equir □d on the drawings and **/**or speci ied elsewher □ will be required by this section **:**

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
1.	Equipment Motors	21/22/23	21/22/23	26
2.	Magnetic Motor Starters			
	a. Automatically controlled, with or without HOA switches	21/22/23	26	Notes 1,3,5
	b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment	21/22/23	22/23	Notes 1,3,5
	c. Manually controlled	21/22/23	26	Notes 1,3,5
	d. Manually controlled and furnished as part of factory wired equipment	21/22/23	26	Notes 1,3,5
	e. Furnished in Motor Control Centers	26	26	Notes 1,3,5
3.	Variable Speed (Frequency) AC Drives	22/23	26	Notes 1,4,5
4.	Line voltage thermostats, time clocks, etc., not connected to control panel systems	23	26	23
5.	Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached	22/23	22/23	22/23

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
	to ducts, pipes, etc.			
6.	Temperature control panels and time switches mounted on temperature control panels	23	23	23
7.	Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc.	23	23	Note 1
8.	Alarm bells furnished with equipment installed by Division 22 or 23	22/23	22/23	22/23
9.	Wiring to obtain power for control circuits, including circuit breaker	21/22/23	21/22/23	21/22/23
10.	Low voltage controls	21/22/23	21/22/23	21/22/23
11.	Fire protection system (sprinkler) controls	21	21	Note 8
12.	Fire and smoke detectors installed on mechanical units and in ductwork	28	23	Note 8
13.	All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment	23	23	Note 1
14.	Smoke dampers, and combination fire/smoke dampers	23	23	Note 7
15.	Boiler and water heater controls, boiler burner controls panels	22/23	22/23	22/23
16.	Pushbutton stations, pilot lights	22/23	22/23	22/23
17.	Heat Tape	21/22/23	21/22/23	26
18.	Disconnect switches, manual operating switches furnished as a part of the equipment	21/22/23	21/22/23	Notes 1,5
19.	Disconnect switches, manual operating switches furnished separate from equipment	26	26	26
20.	Multispeed switches	23	23	26
21.	Thermal overloads	21/22/23	21/22/23	21/22/23
22.	Control relays, transformers	21/22/23	21/22/23	21/22/23
23.	Refrigeration cycle, cooling tower and controls	23	23	23
24.	Tamper switches for fire	21	21	28

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
	protection (sprinkler) system			
25.	Flow and/or pressure switches for fire protection (sprinkler) system	21	21	28
26.	Fire and jockey pump controllers and automatic transfer switch	21	21	Note 6
27.	Alarm bells or horns for fire protection (sprinkler) system	21	21	28
28.	Generator (underground) fuel tank	22	22	--
29.	Generator fuel level indicator	22	22	26
30.	Generator fuel piping from tank to generator	22	22	--
31.	Underground fuel tank leak detection and monitoring system	22	22	22

NOTES:	(1)	Power wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 26; control wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 21/22/23.
	(2)	Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 26 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 specifications, Division 26 and Drawings for more specific requirements.
	(3)	For requirements for Magnetic Motor Starters, refer to Section 238965.
	(4)	For requirements for Variable Speed (Frequency) AC drives, refer to Section 238965.
	(5)	Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.
	(6)	Power wiring from energy source to controllers and automatic transfer switch provide shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 21, 22 or 23 and conforming to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.
	(7)	Division 26 will provide power to all smoke and combination fire/smoke dampers, and Division 28 will provide control for all such dampers using area smoke detectors.

	(8)	Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

B. CONNECTIONS: Make all connections to controls that are directly attached to ducts, piping and mechanical equipment with flexible connections.

C. PRECEDENCE
   1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.
   2. Precedence for pipe, conduit and duct systems shall be as follows.
      a. Building lines
      b. Structural members
      c. Soil and drain piping
      d. Vent piping
      e. Condensate piping
      f. Refrigerant piping
      g. Electrical bus duct
      h. Supply ductwork
      i. Return ductwork
      j. Exhaust ductwork
      k. Chilled water and heating water piping
      l. Automatic Fire Protection Sprinkler Piping
      m. Natural gas piping
      n. Domestic hot and cold water piping
      o. Electrical conduit
   3. Lighting Fixtures shall have precedence over air grilles and diffusers.

D. FINAL INSPECTION AND REPORT
   1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical Fire Alarm and Temperature Control Contractors, representatives of mechanical and electrical equipment manufactures whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies that they represent, shall be filed with the Owner and Architect or Engineer.

END OF SECTION

SECTION 22 05 29
PLUMBING SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of supports and anchors required by this section is indicated on Drawings and/or specified in other Division 22 sections.

B. Types of supports and anchors specified in this section include the following:
   1. Pipe and equipment hangers, supports, and anchors.
   2. Equipment bases.

C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
   2. MSS Standard Compliance:
      a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
      b. Select and apply pipe hangers and supports, complying with MSS SP-69.
      c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
      d. Terminology used in this section is defined in MSS SP-90.

C. All hangers, supports and attachments shall be manufactured with materials compatible with the environment in which they will be installed. Unless directed otherwise, all hangers, supports, and attachments installed exterior to the building or within high humidity environments shall be stainless steel.

D. Manufacturers of Hangers and Supports:
   1. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
      a. B-Line Systems Inc. (Cooper)
      b. ANVIL International

1.03 SUBMITTALS

A. Submit product data and shop drawings as required under provisions of Division 01 and Section 22 00 10.

B. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

C. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

D. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 01.

PART 2 - PRODUCTS

2.01 HORI□ONTAL-PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.

B. Adjustable Steel Clevis Hangers: MSS Type 1.

C. Yoke Type Pipe Clamps: MSS Type 2.

D. Steel Pipe Clamps: MSS Type 4.

E. Pipe Hangers: MSS Type 5.

F. Adjustable Swivel Pipe Rings: MSS Type 6.

G. Clips: MSS Type 26.

H. Single Pipe Rolls: MSS Type 41.

I. Adjustable Roller Hangers: MSS Type 43.

2.02 VERTICAL-PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

B. Two-Bolt Riser Clamps: MSS Type 8.

2.03 HANGER-ROD ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

B. Steel Turnbuckles: MSS Type 13.

C. Steel Clevises: MSS Type 14.

D. Malleable Iron Sockets: MSS Type 16.

E. Steel Weldless Eye Nuts: MSS Type 17.

2.04 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

B. Side Beam or Channel Clamps: MSS Type 20.

C. Center Beam Clamps: MSS Type 21.

D. Welded Beam Attachments: MSS Type 22.

E. C-Clamps: MSS Type 23.

F. Top Beam Clamps: MSS Type 25.

G. Side Beam Clamps: MSS Type 27.

H. Steel Beam Clamps W/Eye Nut: MSS Type 28.
I. Linked Steel Clamps W/Eye Nut: MSS Type 29.
J. Malleable Beam Clamps: MSS Type 30.
K. Steel Brackets: One of the following for indicated loading:
    1. Light Duty: MSS Type 31, suspending 750 lbs. max.
    2. Medium Duty: MSS Type 32, suspending 1500 lbs. max.
    3. Heavy Duty: MSS Type 33, suspending 3000 lbs. max.
L. Side Beam Brackets: MSS Type 34.
M. Plate Lugs: MSS Type 57.
N. Horizontal Travelers: MSS Type 58.

2.05 CONCRETE INSERTS

A. Cast-In-Place Spot Type: Malleable iron, or steel with recommended insert nut. Size inserts nut to suit threaded hanger rod. MSS SP-69, Type 18.
B. Drill-In Spot Type: Steel, attached wedge, lock washer and nut. Size inserts to suit threaded hanger rod.
    1. Acceptable Manufacturers and Models:
        a. Hilti "Kwik Bolt"
        b. Ramset "Wedge Anchor"
        c. Rawl "Stud"
C. Continuous Channel Type: Steel, anchoring lugs, with channel nuts, rated for 2000 lbs. per foot minimum load. Size channel nut to suit threaded hanger rod.
    1. Acceptable Manufacturers and Models:
        a. B-Line B22
        b. Elcen 1150
        c. Unistrut P3200

2.06 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.
B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.
C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.
D. Thermal Hanger Shields: Constructed of 360° insert of high density, 125-psi compressive strength, and water-proofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.
    1. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:
        a. Elcen Metal Products Co.
        b. Pipe Shields, Inc.

2.07 SPRING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated spring hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.
B. Restraint Control Devices: MSS Type 47.

C. Spring Cushion Hangers: MSS Type 48.
D. Spring Cushion Roll Hangers: MSS Type 49.
E. Spring Sway Braces: MSS Type 50.
F. Variable Spring Hangers: MSS Type 51; preset to indicated load and limit variability factor to 25%.
G. Variable Spring Base Supports: MSS Type 52; preset to indicated load and limit variability factor to 25%; include load flange.
H. Variable Spring Trapeze Hangers: MSS Type 53; preset to indicated load and limit variability factor to 25%.
I. Constant Supports: Provide one of the following types, selected to suit piping system. Include auxiliary stops for erection and hydrostatic test, and field load-adjustment capability.
    1. Horizontal Type: MSS Type 54.
    2. Vertical Type: MSS Type 55.
    3. Trapeze Type: MSS Type 56.

2.08 MANUFACTURERS OF HANGERS AND SUPPORTS

A. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
    1. B-Line Systems Inc.
    2. ITT Grinnell Corp.

2.09 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.
B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.
C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.
D. Auxiliary Steel: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.
E. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

2.10 ROOF EQUIPMENT SUPPORTS

A. General: Construct roof equipment supports using minimum 18-ga galvanized steel with fully mitered and welded corners, 3 in. cant, internal bulkhead reinforcing, integral base plates, pressure treated wood nailer, and 18-ga galvanized steel counter flashing.
B. Configuration: Construct of sizes as indicated, compensate for slope in roof so top of support is dead level.
C. Manufacturer: Subject to compliance with requirements, provide roof equipment supports of one of the following:
    1. Pate Co.
    2. Thycurb Div.; Thybar Corp.

2.11 ROOF PIPING SUPPORTS

A. Single run pipe 2-1/2 in. O.D. and less, shall have Type SS8-R as manufactured by PHP Systems/Design, or an approved equal, spaced at a maximum 8 ft. o.c. and installed on roof pads if required by Roofing Manufacturer. Use roller support for all straight piping lengths of 50 ft. or greater. All piping on fixed support shall be strapped to support channel. Coordinate exact locations of supports with Roofing Contractor. Do not use wood blocking under supports.

B. Provide adjustable height threaded rod assembly supports as manufactured by MAPA Products Model MS-1/MS-1-E or equal for supporting roof mounted condensate drain piping for pipe up to 2 in. Supports shall consist of a reinforced nylon support base, clamped pipe support bracket, and an adjustable threaded rod height assembly. A neoprene pad shall be adhered to the base. Install per manufacturer's instructions. Coordinate exact locations of supports with contractor.

C. All refrigerant piping on the roof shall be supported with Pipe Pier model PP050 piping supports . Spacing of pipe supports shall not exceed 8 ft. for pipes up to 1-1/4 in. and 10 ft. on all other piping. Coordinate exact locations of supports with Roofing Contractor. Install piping supports per manufacturer's instructions. Pipe supports shall be constructed of 10 in. L x 4 in. W x 4 in. H closed cell, medium density black polyethylene foam with a 14 gauge channel strut adhesively bonded to the polyethylene foam. Roofing Contractor shall provide roofing material pads under all supports.

2.12 ROOF PENETRATION SYSTEMS

A. General: Construct roof penetration systems utilizing the "Alumi-Flash" system by Portals Plus, Inc., or equal by Thy-Curb.

B. Each roof penetration shall include a spun aluminum base ("High" size if required due to the existing roof construction and any insulation thickness) and an EPDM rubber cap. Each rubber cap shall have a pre-molded pipe opening and shall be selected based on the actual pipe or conduit size required at each location. Secure each rubber cap to each pipe or conduit with the manufacturer's recommended stainless steel gear clamp.

C. Manufacturer: Subject to compliance with requirements, provide roof penetration systems of one of the following:

1. Portals Plus, Inc. Ron Widby 800-774-5240
2. Thycurb Div.; Thybar Corp. Jr. Gracia 972-416-6220

2.13 CONCRETE HOUSEKEEPING BASES

A. Concrete housekeeping bases shall be in accordance with Division 03 and constructed of 3,000 psi concrete and reinforced with welded wire fabric in accordance with ASTM A 185 or deformed reinforcing bar in accordance with ASTM A 615, Grade 60.

B. Reinforcement shall be provided for base thickness as follows unless otherwise noted:

	Thickness of Base	Size and Type of Reinforcement	Spacing and Location of Reinforcement
	4 in.	W 2.9 x 2.9 welded	6 in. x 6 in. at centerline of pad
	6 in.	No. 3 bars	18 in. on center each way (3 in. from top of pad)
	8 in.	No. 4 bars	18 in. on center each way (3 in from top of pad)
	12 in.	2 sets of No. 4 bars	Two mats 18 in. on center each way (3 in. from top of pad and 3 in. from bottom of pad)

2.14 SLEEVES, INSETS AND FASTENINGS

A. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at all changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Install additional at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at all changes in direction of piping. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire-water piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports that are copper plated, or by other recognized industry methods.

E. Support and laterally brace vertical pipe runs at every floor level and at intervals not to exceed 20 ft. 0 in. Support vertical pipe with riser clamps installed below hubs, couplings or lugs welded to the pipe.

F. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
3. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

G. Insulated Piping: Comply with the following installation requirements.
   1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
   2. Piping hangers shall be sized large enough to allow insulation to pass through. Hangers for piping 2-1/2 in. and greater shall be provided with pipe covering protection saddle, or high compressive strength insulation saddle. Hangers for piping 2 in. and less shall be provided with pipe covering shields. On cold or chilled water piping provide vapor barrier through hanger.
   3. Do NOT utilize "pipe size" hangers with insulation placed over the pipe and hanger.

H. Unless directed otherwise, all hangers, supports, and attachments installed exterior to the building or within high humidity environments shall be galvanized steel or stainless steel.

3.05 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.06 CONCRETE HOUSEKEEPING BASES

A. Concrete housekeeping bases will be provided as work of Division 03. Furnish to Contractor, scaled layouts of all required bases, with dimensions of bases, and location to column centerlines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

B. Provide concrete housekeeping bases for all floor-mounted equipment furnished as part of the work of Division 22 in accordance with Division 03. Size bases to extend minimum of 4 in. beyond equipment base in any direction; and 4 in. above finished floor elevation, unless otherwise noted on Drawing. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

3.07 EQUIPMENT SUPPORTS

A. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

B. Furnish roof equipment supports to Contractor for installation as part of work of Division 07; not work of this section.

3.08 ADJUSTING AND CLEANING

A. Hanger Adjustments: Adjust hangers so as to distribute loads equally on attachments.

B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 22 05 53
PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of mechanical identification work required by this section is indicated on Drawings and/or specified in other Division 22 sections.

B. Types of identification devices specified in this section include the following:
   1. Plastic Pipe Markers.
   2. Underground-Type Plastic Line Marker.
   3. Valve Tags.
   4. Valve Schedule Frames.
   5. Engraved Plastic-Laminate Signs.
   6. Plastic Equipment Markers.

C. Plumbing identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division 22 sections.

D. Refer to other Division 22 sections for identification requirements at central-station mechanical control center; not work of this section.

E. Refer to Division 21, 23 and 26 sections for identification requirements of fire protection, mechanical and electrical work; not work of this section.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2 in. x 11 in. bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 01.

C. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:
   1. Allen Systems, Inc.
   2. Brady (WHO) Co.; Signmark Div.
   3. Industrial Safety Supply Co., Inc.
   4. Seton Name Plate Corp.

2.02 IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.03 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

B. Small Pipes: For external diameters less than 6 in. (including insulation if any), provide full-band pipe markers, extending 360° around pipe at each location, fastened by one of the following methods:
   1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   2. Adhesive lap joint in pipe marker overlap.
   3. Laminated or bonded application of pipe marker to pipe (or insulation).
   4. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4 in. wide; full circle at both ends of pipe marker, tape lapped 1-1/2 in.

C. Large Pipes: For external diameters of 6 in. and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
   1. Laminated or bonded application of pipe marker to pipe (or insulation).
   2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2 in. wide; full circle at both ends of pipe marker, tape lapped 3 in.
   3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

D. Lettering: Manufacturer's standard pre-printed nomenclature that best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with name as shown or specified.

2.04 UNDERGROUND-TYPE PLASTIC LINE MARKERS

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6 in. wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.
   1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.05 VALVE TAGS

A. Brass Valve Tags: Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4 in. high letters and sequenced valve numbers 1/2 in. high, and with 5/32 in. hole for fastener.
   1. Provide 1+ in. diameter tags, except as otherwise indicated.
   2. Provide size and shape as specified or scheduled for each piping system.
   3. Fill tag engraving with black enamel.

B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

C. Access Panel Markers: Provide manufacturer's standard 1/16 in. thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8 in. center hole to allow attachment.

2.06 VALVE SCHEDULE FRAMES

A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.07 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16 in., except as otherwise indicated.

C. Thickness: 1/8 in., except as otherwise indicated.

D. Thickness: 1/16 in. for units up to 20 sq. in. or 8 in. length; 1/8 in. for larger units.

E. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.08 PLASTIC EQUIPMENT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color-coded equipment markers. Conform to the following color code:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Yellow/Green: Combination cooling and heating equipment and components.
4. Brown: Energy reclamation equipment and components.
5. Blue: Equipment and components that do not meet any of the above criteria.
6. Red: Fire protection equipment and components.
7. For hazardous equipment, use colors and designs recommended by ANSI A13.1.

B. Nomenclature: Include the following, matching terminology on schedules as closely as possible:

1. Name and plan number.
2. Equipment service.
3. Design capacity.
4. Other design parameters such as pressure drop, entering and leaving conditions, rpm, etc.

C. Size: Provide approximate 2-1/2 in. x 4 in. markers for control devices, dampers, and valves; and 4-1/2 in. x 6 in. for equipment.

2.09 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification that indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces that require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
   1. Stenciled markers, including color-coded background band or rectangle, and contrasting lettering of black or white. Extend color band or rectangle 2 in. beyond ends of lettering.

B. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
   1. Near each valve and control device.
   2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
   3. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
   4. At access doors, manholes and similar access points that permit view of concealed piping.
   5. Near major equipment items and other points of origination and termination.
   6. Spaced intermediately at maximum spacing of 50 ft. along each piping run, except reduce spacing to 25 ft. in congested areas of piping and equipment.
   7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

C. Piping Identification:

	System	Background Color	Text Color
	Domestic Cold Water	Green	White
	Domestic Hot Water	Yellow	Black
	Domestic Hot Water - Recirculated	Yellow	Black
	Natural Gas	Yellow	Black
	Storm Drain	Green	White

3.03 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top-soiling of each exterior underground piping systems, install continuous underground-type plastic line marker, located directly over buried line at 6 in. to 8 in. below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16 in., install single line marker. For tile fields and similar installations, mark only edge pipelines of field.

3.04 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
   1. Tagging Schedule: Comply with requirements of "Valve Tagging Schedule" at end of this section.

B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect.
   1. Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than single machine room.

3.05 PLUMBING EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of plumbing equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
   1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   2. Meters, gauges, thermometers and similar units.
   3. Fuel-burning units including boilers, furnaces, heaters, stills and absorption units.
   4. Pumps and similar motor-driven units.
   5. Tanks and pressure vessels.
   6. Strainers, filters and similar equipment.

B. Optional Sign Types: Where lettering larger than 1 in., height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.

C. Lettering Size: Minimum 1/4 in. for distances up to 6 ft. 0 in., and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

D. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.
   1. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at Installer's option, be identified by installation of plasticize tags in lieu of engraved plastic signs.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device, which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.07 EXTRA STOCK

A. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.

END OF SECTION

SECTION 22 05 93
PLUMBING TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 SUMMARY

A. Adjust and balance plumbing hot water recirculation systems

B. Check each piece of operating equipment provided under Division 22.

C. Provide Balancing Report

1.02 QUALITY ASSURANCE

A. Independent Subcontractor: All testing, adjusting and balancing shall be performed by a Testing, Adjusting and Balancing firm that is independent from the plumbing systems installer.

B. Balancing Work: Under direct supervision of AABC accredited testing organization certified supervisor.

1.03 REFERENCES

A. Reference Standards: Comply with AABC National Standards for Total System Balance, latest edition.

1.04 SUBMITTALS

A. Certificate: Before beginning work, submit certification of AABC certified supervisor and AABC firm certification in accordance with Section 22 00 10.

B. Balancing Report: At completion of work, submit balancing report in accordance with Section 22 00 10. After adjustments have been made submit three (3) copies of a complete detailed report on mechanical systems and their operation to include:

1. Blackline prints with balance valves marked to correspond with data sheets and with thermometer locations clearly marked.
2. Data sheets showing amount of water at balance valves, instrument used.
3. Operating data including pump RPM, measured motor current and voltage BHP and flow (GPM).
4. Equipment and operating data including water temperatures entering and leaving the thermostatic mixing valve(s).
5. A statement outlining any abnormal or notable conditions not covered in above data. Make special note of any discrepancies between tabulated data and specified conditions.

1.05 PROJECT CONDITIONS

A. Existing Conditions: Verify following conditions before proceeding with work:

1. Installation of the designated system is complete and in full operation.

PART 2 - PRODUCTS

2.01 INSTRUMENTS

A. Calibration and maintenance of instruments shall be in accordance with manufacturer's standards and recommendations and requirements of AABC.

B. Calibration histories for each instrument shall be available for examination.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect preceding work in accordance with Section 22 00 10 - BASIC PLUMBING REQUIREMENTS.

3.02 PREPARATION

A. Water Systems: Check:

1. Strainers are clean.
2. Automatic control valves operation.
3. Pump rotation.

4. Other conditions as required.

3.03 ADJUSTING AND BALANCING

A. General: Check, adjust and balance hot water recirculation system to meet the design performance and tabulate results on acceptable forms. Minimum data to include amperage, voltage input, and thermal heater capacity of each pump, equipment nameplate data and operating speed, pressure rise across each pump, GPM capacity of each balance valve.

B. Test Run: In order to determine that the system installation is complete and will operate satisfactorily, make a test run with equipment operating per normal temperature control schedule and sequence. Run test and operate and adjust equipment as may be required during test run.

3.04 COMPLETION SERVICES

A. Final Check: Make final checks and do any rebalancing as directed.

B. Report: Submit Balancing Report as specified above.

C. Acceptance: Final acceptance of the project will not be made until a satisfactory report is received. Owner reserves the right to spot check the report by field verification prior to final acceptance.

END OF SECTION

SECTION 22 07 16
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of plumbing insulation required by this section is indicated on Drawings and schedules, and by requirements of this section.

B. Types of mechanical insulation specified in this section include the following:
   1. Piping System Insulation:
      a. Fiberglass.
   2. Equipment Insulation:
      a. Fiberglass.

C. Refer to Section 22 05 29 - PLUMBING SUPPORTS AND ANCHORS for protection saddles, protection shields, and thermal hanger shields; not work of this section.

D. Refer to Section 22 05 53 - PLUMBING IDENTIFICATION for installation of identification devices for piping and equipment; not work of this section.

1.02 REFERENCES

A. North American Commercial and Industrial Insulation Standards. 9th Edition or Latest Edition. Published by Midwest Insulation Contractors Association (MICA).

B. NAIMA CI228 Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation 33°F to 60°F (0.5°C to 15.6°C) First Edition, 2015. Published by North American Insulation Manufacturers Association (NAIMA).

C. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials.

D. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

E. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.

F. ASTM C335 Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation.

G. ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.

H. ASTM C547 Standard Specifications for Mineral Fiber Pipe Insulation.

I. ASTM C585 Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for nominal sizes of Pipe and Tubing (NPS System).

J. ASTM C795 Standard Specifications for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.

K. ASTM C1136 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.

L. ASTM C1393 Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical (insulating material, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (UL723) method.
   1. Exception: Outdoor mechanical insulation may have flame-spread index of 75 and smoke developed index of 150.

2. Exception: Industrial mechanical insulation that will not affect life safety egress of building may have flame-spread index of 75 and smoke developed index of 150.

D. Insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or poly-brominated diphenyl ether fire retardants.

E. Fiberglass insulations shall have a minimum of 50 percent recycled glass content; certified and UL validated.

F. Fiberglass insulations shall have a bio-based, formaldehyde-free binder and be UL GREENGUARD gold certified.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:

1. Fiberglass Products:
    a. Knauf Insulation
    b. Manson Insulation
    c. Owens / Corning
    d. Johns Manville
2. PVC Fitting Covers / Jacket:
    a. Proto LoSmoke PVC
    b. Johns Manville Zeston PVC
3. Coatings, Sealants, and Adhesives:
    a. Childers Products / H.B. Fuller Construction Products
    b. Foster Products / H.B. Fuller Construction Products
    c. Vimasco Corporation
    d. Mon-Eco Industries

2.02 PIPING INSULATION MATERIALS

A. Fiberglass Piping Insulation: ASTM C 547, Type 1 unless otherwise indicated.

B. Jackets for Piping Insulation: ASTM C 921 and ASTM C 1136, Type I (Vapor Barrier) for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installer’s option.

1. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations, ASTM D 1784.
2. Encase exterior piping insulation with aluminum jacket with weather-proof construction, ASTM C 1729.

C. Staples, Bands, Wires and Cement: As recommended by insulation manufacturer for applications indicated.

D. Adhesives, Sealers and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

2.03 EQUIPMENT INSULATION MATERIALS

A. Rigid Fiberglass Equipment Insulation: ASTM C 612, Type 1A.

B. Flexible Fiberglass Equipment Insulation: ASTM C 553, Type I

C. Jacketing Material for Equipment Insulation: Provide pre-sized glass cloth jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.

D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

1. Encase exterior equipment insulation and all piping exposed within 6'0" of the floor within kitchen areas with aluminum jacket with weatherproof construction, ASTM C 1729.

E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

2.04 METAL PROTECTIVE JACKET

A. Sheet aluminum: ASTM C1729, 3003 alloy, H-14 temper, and 0.016 in. thick. Provide moisture barrier lining for service temperatures 60°F or less except where applied over a Type I or II jacket. Longitudinal lap shall be at least two in. wide.

B. Stainless Steel: ASTM C1729, manufactured from T-304 prime grade Stainless Steels, supplied with a regular dull finish for reduced glare and 0.016 in. thick. These alloys shall be of a soft-annealed temper, for ease in fabrication. Jacketing shall be used for insulated piping, tanks, and vessels less than 8 ft. in diameter. Deep corrugated sheets shall be used for diameters greater than 8 ft. Roll jacketing shall be 3/16 in. corrugated.

C. Fitting covers: Factory fabricated from not lighter than 0.020 in. thick type 3003 sheet aluminum.

D. Bands: 3/4 in wide aluminum on maximum 18 in. centers.

E. Provide metal jackets over insulation as follows:

1. All piping exposed to outdoor weather.
2. Piping exposed in building within five (5) ft. of the floor that connect to sterilizers, kitchen and laundry equipment.Seal without the use of screens or pop rivits. Provide aluminum angle ring escutcheons at wall, ceiling and floor penetrations.
3. A two in. overlap is required at longitudinal and circumferential joints.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Thickness of insulation shall be as recommended by the manufacturer for the temperatures and pipe sizes involved, and in accordance with standards of North American Insulation Manufacturers Association (NAIMA).

3.02 PLUMBING PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre-insulated equipment.

B. Cold Piping:

1. Application Requirements: Insulate the following cold plumbing piping systems:
   a. Potable cold water piping.

b. Interior horizontal above-ground storm water piping from roof drains and overflow drains.
c. Plumbing vents within 6 linear ft. of roof outlet.
d. Condensate drains from HVAC units, refrigerated equipment, etc., including traps and lateral lines concealed above ceilings.
e. Waste and vent piping above grade and located outside the building insulation envelope.

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
a. Fiberglass: 1 in. thickness; ½ in. thick for condensate drain piping.

C. Hot Piping:
1. Application Requirements: Insulate the following hot plumbing piping systems:
a. Potable hot water piping.
b. Potable hot water recirculating piping.
c. Hot drain piping (where indicated).

2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
a. Fiberglass (Above Ground Only): 1 in. thick for pipe sizes up to and including 1-1/4 in., 1-1/2 in. thick for pipe sizes 1-1/2 in. and larger.
b. All insulation requirements shall comply with applicable edition of IECC.

3.03 EQUIPMENT INSULATION

A. Cold Equipment (Below Ambient Temperature):
1. Application Requirements: Insulate the following cold equipment:
a. Cold water storage tanks.
b. Water softeners.
c. Floor drain bodies, traps, and 2 ft. 0 in. of drain piping located in floors above grade receiving condensate below ambient temperature.

2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
a. Fiberglass: 1 in. thick for surfaces above 35°F (2°C) and 1-1/2 in. thick for surfaces 35°F (2°C) and lower.

B. Hot Equipment (Above Ambient Temperature):
1. Application Requirements: Insulate the following hot equipment:
a. Water heaters.

2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
a. Fiberglass: 2 in. thick, except 3 in. thick for low-pressure boilers and steam-jacketed heat exchangers.
b. Calcium Silicate: 3 in. thick, except 4-1/2 in. thick for low-pressure boilers and steam-jacketed heat exchangers.

3.04 INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor-retarder jackets on pipe insulation, and protect to prevent puncture or other damage. All penetrations of the jacket and exposed ends of insulation shall be sealed with vapor barrier coating.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3 in. wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 in. wide vapor barrier tape or band.

I. Do NOT insulate over pipe hangers. If pipe hangers for piping to be insulated are not adequately sized for insulation to pass through the hanger, notify the General Contractor and Architect.

3.05 INSTALLATION OF EQUIPMENT INSULATION

A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices detailed by the North American Commercial and Industrial Insulation Standards manual (latest edition).

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gapping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor-retarder on equipment insulation and protect it to prevent puncture and other damage.

D. Do not apply insulation to equipment, breechings, or stacks while hot.

E. Apply insulation using staggered joint method for double layer construction, where feasible. Apply each layer of insulation separately.

F. Coat insulated surfaces with layer of insulating cement, trowelled in workmanlike manner, leaving smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2 in. Apply over vapor barrier where applicable.

H. Do not insulate boiler manholes, hand-holes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

I. Provide removable insulation sections to cover parts of equipment that must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

3.06 INSULATION EXPOSED TO WEATHER

A. Protect outdoor insulation from weather by installation of weather-barrier metal jacketing. It may be factory-applied or field applied. Joints shall be overtapped a minimum of 2 inches. Securement shall be accomplished by using stainless steel bands. Any vapor-barrier jacket or coating under the metal jacketing shall not be disturbed or punctured by the use of screws or rivets on the outer jacket.

3.07 EXISTING INSULATION REPAIR

A. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

3.08 PROTECTION AND REPLACEMENT

A. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture-saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 22 10 00
PLUMBING PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of Plumbing Piping Work required by this section is indicated on Drawings and by requirements of this section.

B. Types of Plumbing Piping systems specified in this section include the following:
   1. Sanitary waste and vent system.
   2. Domestic water system.
   3. Non-potable water system.
   4. Miscellaneous Drain Lines
   5. Natural gas system.
   6. Trap primer-piping system.

1.02 REFERENCES

A. ANSI/ASME B16.18 - Cast Copper Alloy Solder - Joint Pressure Fittings.

B. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings Class 150 NS 300.

D. ANSI/ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV.

E. ANSI/ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

F. ANSI/ASME Sec. 9 - Welding and Brazing Qualifications.

G. ANSI/ASTM B32 - Solder Metal.

H. ANSI/ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

I. ANSI/AWS D1.1 - Structural Welding Code.

J. AWS D10.12 - Recommended Practices and Procedures for Welding Plain Carbon Steel Pipe.

K. AWS D10.9 - Qualifications and Procedures for Piping and Tubing Welding.

L. AWS B3.0 - Welding Procedure and Performance Qualification.

M. ANSI/AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.

N. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings 3 in. through 48 in., for Water and Other Liquids.

O. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings.

P. ANSI/AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

Q. ASME - Boiler and Pressure Vessel Code.

R. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

S. ASTM A74 - Cast Iron Soil Pipe and Fittings.

T. ASTM A120 - Pipe, Steel, Black and Hot-Dipped Zinc Coated (Galvanized), Welded and Seamless, for Ordinary Uses.

U. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

V. ASTM A888/ CISPI Standard 301 for Cast Iron hubless pipe and fittings.

W. ASTM B88 - Seamless Copper Water Tube.

X. ASTM B306 - Copper Drainage Tube (DWV).

Y. ASTM C14 - Concrete Sewer, Storm Drain, and Culvert Pipe.

Z. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

AA. ASTM C 1540 - Heavy Duty Shielded Hubless Couplings
BB. ASTM D2235 - Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings.
CC. ASTM D2321 - Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-flow Applications.
DD. ASTM D2513 - Thermoplastic Gas Pressure Pipe, Tubing and Fittings.
EE. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe.
FF. ASTM E84 - Standard test method for surface burning characteristics of building materials.
GG. ASTM F2657 - Standard Test Method for Outdoor Weathering Exposure of Crosslinked Polyethylene (PEX) Tubing
HH. AWS A5.8 - Brazing Filler Metal.
II. AWWA C651 - Standard for Disinfecting Water Mains.
JJ. AWWA C601 - Standard Methods for the Examination of Water and Waste Water.
KK. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.
LL. CISPI 310 - Couplings for Use with Hubless Cast Iron Soil Pipe and Fittings.
MM. NFPA 24 - Installation of private fire service mains and their Appurtenances, latest edition.
NN. NFPA 54 - National Fuel Gas Code, latest edition.
OO. ANSI LC-1 / CSA 6.26 - Use and Installation of Corrugated Stainless Steel Tubing (CSST).

1.03 QUALITY ASSURANCE

A. Plumbing Certification: Persons performing plumbing work shall have a current Texas State Plumbing License.
B. Valves: Manufacturer's name and pressure rating marked on valve body.
C. Welding Materials and Procedures: Conform to ASME Code and AWS 10.12.
D. Welders Certification: In accordance with ANSI/ASME Sec. 9 or AWS D1.1, AWS D10.9, and AWS B3.0, as applicable.
E. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or receive prior approval of the engineer.
F. All adhesives, sealants and sealant primers shall contain low VOC (Volatile Organic Compounds), as outlined in the South Coast Air Quality Management District (SCAQMD) Rule #1168. The design intent for this project is to obtain LEED Credit 4.1, which requires that all adhesives, sealants and sealant primers comply with the SCAQMD Rule #1168.

1.04 REGULATORY REQUIREMENTS

A. Conform to the most recent editions of the applicable City codes and ordinances and NFPA 54.
B. Piping materials specified herein are acceptable products to the Architect, but all are not necessarily acceptable to applicable local codes and ordinances. It is the responsibility of the Contractor to provide materials, from the options listed herein, that are acceptable to both the Architect and applicable local codes and ordinances.

1.05 SUBMITTALS

A. Submit product data on pipe materials, fittings, valves and accessories in accordance with Division 01 and Section 22 00 10.
B. Submit shop drawings and piping layout in accordance with Division 01 and Section 22 00 10.
C. Submit certificates as listed below to Architect in accordance with Division 01 and Section 22 00 10.
    1. Test Certificates of Approval for Piping Systems.
    2. Flushing Certificates of Approval for Piping Systems.
    3. Disinfection Certificates of Approval for Domestic Water Piping Systems.

1.06 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

PART 2 - PRODUCTS

2.01 SANITARY WASTE AND VENT PIPING

A. Sanitary waste and vent piping, below grade.
   1. Cast Iron Pipe & Fittings: ASTM A74 service weight. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.
   2. PVC Pipe: ASTM D2665, Schedule 40. Fittings: PVC DWV Type, Schedule 40, and ASTM D2665. Joints: ASTM D2855 and D2564, solvent weld. Reference ASTM D23221 for installation.

B. Sanitary waste and vent piping, above grade.
   1. Cast Iron Pipe & Fittings: CISPI 301, hubless. Joints: ASTM C 564, neoprene gaskets and stainless steel clamp-and-shield assemblies. Joints shall be Heavy Duty couplings conforming to ASTM C 1540 as manufactured by Husky SD 4000 or Clamp All 125.
   2. Copper Pipe: ASTM B306, DWV. Fittings; ANSI/ASME B16.3, cast bronze, or ANSI/ASME B16.29, wrought copper. Joints: ANSI/ASTM B23, solder, Grade 50B.
   3. PVC Pipe: ASTM D2665, Schedule 40. Fittings: PVC DWV Type, Schedule 40, ASTM D2665. Joints: ASTM D2855 and D2564, solvent weld.

C. Sanitary waste and vent piping for aggressive applications, below grade.

   [i.e. Exposure to undiluted cleaning chemicals with a pH range of 2 to 12, Hospitals, Casinos, Commercial kitchens, Soda fountains, Bar sinks, Parking garages.]

   1. Epoxy coated Cast Iron Pipe and Fittings, ASTM A74 service weight. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets. Epoxy cast iron pipe shall be Charlotte Edge HP or by NewAge Casting.

D. Sanitary waste and vent piping for aggressive application, above grade.

   [i.e. Exposure to undiluted cleaning chemicals with a pH range of 2 to 12, Hospitals, Casinos, Commerical kitchens, Soada fountains, Bar sinks, Parking garages.]

   1. Epoxy coated Cast Iron Pipe and Fittings, ASTM A888/CISPI 301, hubless. Joints: ASTM C564 neoprene gaskets and Heavy Duty stainless steel clamp-and-shield assemblies conforming to ASTM C1540. Epoxy cast iron pipe shall be Charlotte Edge HP or by NewAge Casting.

2.02 WATER PIPING

A. Water piping buried within 5 ft. of building, and beneath slab.
   1. Copper Tubing: For 2-1/2 in. diameter and less, ASTM B88, Type "K" . Fittings: ANSI/ASME B16.18, cast copper or ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.

B. Water piping, above grade.
   1. Copper Tubing: For 4 in. diameter and less, ASTM B88, Type "L", hard drawn. Fittings: ANSI/ASME B16.18, cast brass, or ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA.
   2. Mechanically pressed copper fittings are acceptable for pipe sizes 1/2 in. through 4 in. diameter. Operating pressure: 200 PSI CWP Max, Temperature range: -20°F to 250°F. Fittings shall conform with ASME B16.18, ASME B16.22 or ASME B16.26, and performance criteria of IAPMO PS-117 or ASME B16.51. Fittings shall utilize a factory installed EPDM sealing element and be listed by NSF 61. The installer shall be trained and certified by the fitting manufacturer. Copper press fittings shall be installed using the proper tool, actuator, jaws and rings as instructed by the press fitting manufacturer. Acceptable products are Apollo Press, Viega ProPress or Mueller Industries Streamline PRS.

2.03 MISCELLANEOUS DRAIN PIPING

A. Condensate Drain Piping:
   1. Copper pipe; ASTM B306, DWV fittings; ANSI/ASME B16.3, cast bronze, or AWSI/ASME B16.29, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 50B.
   2. Mechanically pressed copper fittings are acceptable for pipe sizes 1/2 in. through 4 in. diameter. Operating pressure: 200 PSI CWP Max, Temperature range: -20°F to 250°F. Fittings shall conform with ASME B16.18, ASME B16.22 or ASME B16.26, and performance criteria of IAPMO PS-117 or ASME B16.51. Fittings shall utilize a factory installed EPDM sealing element. The installer shall be trained and certified by the fitting manufacturer. Copper press fittings shall be installed using the proper tool, actuator, jaws and rings as instructed by the press fitting manufacturer. Acceptable products are Apollo Press, Viega ProPress or Mueller Industries Streamline PRS.

2.04 NATURAL GAS PIPING

A. Natural gas piping, above grade.
   1. Steel Pipe: ASTM A53 or A120, Schedule 40 black. Fittings: ANSI/ASME B16.3, malleable iron, or ASTM A234, forged steel welding type. Joints: Screwed for pipe two in. and under; ANSI/AWS D1.1, welded, for pipe over two in.
   2. Exterior Steel Piping Above Ground, including all piping on the roof: Field apply two coats of exterior grade enamel paint. Color: As selected by Architect or Gray. Refer to Section 09 90 00 for all requirements.

2.05 TRAP PRIMER PIPING

A. Trap primer piping, buried and above grade.
   1. Copper Tubing: ASTM B88, Type L, annealed. Fittings: ANSI/ASME B16.18, cast copper or ANSI/ASME B16.22, wrought copper. Joints: ANSI/ASTM B32, solder, Grade 95TA. Exposed piping in finished areas shall be chrome plated.

2.06 FLANGES, UNIONS AND COUPLINGS

A. Pipe Size 2 in. and under: 150 psig malleable iron unions for threaded ferrous piping; bronze unions for copper pipe, soldered joints.

B. Pipe Size Over 2 in.: 150 psig forged steel slip-on flanges for ferrous piping; bronze flanges for copper piping; gaskets suitable for intended service – NO ASBESTOS GASKET MATERIAL ALLOWED.

C. Grooved and Shouldered Pipe End Couplings: Malleable iron housing clamps to engage and lock, designed to permit some angular deflection, contraction and expansion; “C” shape composition sealing gasket; steel bolts, nuts, and washers; galvanized couplings for galvanized pipe.
   1. Acceptable Manufacturers:
      a. Victaulic
      b. Apollo Shurjoint

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, and water impervious isolation barrier.

2.07 GATE VALVES

A. Gate valves: For water shut-off.
   1. Gate valves 2 in. and less: MSS-SP-70, rated 175 lb. minimum water pressure, brass or bronze construction screw-in bonnet, rising or non-rising stem, solid wedge disc, threaded or soldered connections.
   2. Acceptable Manufacturers and Models:
      a. Crane 438, 1334
      b. Apollo 101T, 101S

c. Nibco T-111, S-111
d. Grinnell ITT 3010, 3010SJ
e. Milwaukee 148, 149
f. KITZ 807, 808

B. Gate valves: For water shut-off.
1. Gate valves 2-1/2 in. and greater: Rated 150 lb. minimum water pressure, iron body construction, bronze mounted, bolted bonnet, outside screw and yoke, solid wedge disc, flanged connections.
a. Acceptable Manufacturers and Models:
1) Crane 465-1/2
2) Apollo 611F
3) ITT Grinnell 6020A
4) Milwaukee F-2885
5) Nibco F617-0
6) KITZ 72

2.08 BALL VALVES

A. Ball valves: For water shut-off and throttling.
1. Ball valves 2 in. and less: Rated 175 lb. minimum water, oil, air and gas pressure, brass or bronze construction, seat material as recommended by manufacturer for material conveying, lever handle, threaded or soldered connections. Throttling valves shall be provided with memory stops (for establishing any setpoint from 0-100% flow).
a. Acceptable Manufacturers and Models:
1) Crane 9302, 9322
2) Apollo 70 Series
3) Jomar T-100-SS
4) ITT Grinnell 3500, 3500SJ
5) Milwaukee BA-200, BA-250
6) Watts B-6000, B-6001
7) Nibco T-580, & S-500
8) KITZ 868
2. Ball valves 2-1/2 in. and greater, 150 lb. minimum water, oil, air and gas pressure, bronze or carbon steel construction, seat material as recommended by manufacturer for material conveying, lever handle, flanged connections. Throttling valves shall be provided with memory stops (for establishing any setpoint from 0-100% flow).
a. Acceptable Manufacturers and Models:
1) Crane 941-TF
2) Jomar T-100-SS (NPT) or FL-CS-100-150
3) Apollo 88-100
4) Jamesbury D150F
5) KITZ 858 Threaded

B. Ball valves: For deionized water shut-off and throttling.
1. Ball valves: Rated 200 lb. minimum water pressure at 73°F, CPVC constructed body and ball, “Viton” O-ring seals, “Teflon” ball seals, union type, socket type connections.
a. Acceptable Manufacturers and Models:
1) R&G Sloan Asahi/America

2.09 PLUG VALVES

A. Plug valves 2 in. and less: Rated 150 lb. minimum gas air pressure, cast iron body, non-lubricated, resilient plug seal for natural gas, lever handle, threaded or flanged connections.
   1. Acceptable Manufacturers and Models:
      a. DeZurik PEC

B. Plug valves: Rated 150 lb. minimum gas and pressure, cast iron body, non-lubricated, resilient plug seal for natural gas, lever handle, flanged connections.
   1. Acceptable Manufacturers and Models:
      a. Dresser X-Centric
      b. Homestead Ballcentric
      c. DeZurik Series 100
      d. Milliken Series 600

2.10 BUTTERFLY VALVES

A. Butterfly Valves: For water and natural gas shut-off and throttling.
   1. Butterfly valves 2 in. and less: Rated 175 lb. water, oil, air and gas pressure, brass or bronze construction, seat material as recommended by manufacturer for material conveying, lever handle, threaded or soldered connections. Throttling valves shall be provided with memory stops.
      a. Acceptable Manufacturers and Models:
         1) Milwaukee BB2-100, BB2-350
   2. Butterfly valves 2-1/2 in. and greater (for water only): rated 175 lb. water pressure, threaded lug body (rated for dead end service), iron body bronze disc, stainless steel stem, seat material as recommended by manufacturer for material conveying, 10 position lever handle, for flanged connections. Throttling valves shall be proved with memory stops (for establishing any setpoint from 0-100% flow).
      a. Acceptable Manufacturers and Models:
         1) Crane 21
         2) Apollo LD141
         3) ITT Grinnell 8000
         4) Jomar 600/900
         5) De Zurik 660
         6) Nibco LD-2000
         7) Hammond 5200-HI
         8) KITZ 6123, 6121

2.11 CHECK VALVES

A. Swing check valves: For water, air, and pumped waste and drain.
   1. Check Valves 2 in. and less: MSS SP-80 rated 175 lb. minimum water and air pressure, brass or bronze construction, renewable seat, bronze disc, threaded or soldered connections.
      a. Acceptable Manufacturers and Models:
         1) Nibco T-413
         2) Apollo 163T
         3) Crane 137
         4) Jomar T/S-511
         5) Stockham B-321
         6) Milwaukee 508
         7) KITZ 822

2. Check Valves 2-1/2 in. and greater: MSS SP-71 rated 150 lb. minimum water and air pressure, iron body, brass mounted, flanged connections.
    a. Acceptable Manufacturers and Models:
        1) Crane 373
        2) Apollo910F
        3) Nibco F-918
        4) Milwaukee F-2974
        5) ITT Grinnell 6300A
        6) KITZ 78

2.12 PRESSURE REDUCING VALVES

A. Pressure reducing valves: For water.
    1. Pressure Reducing Valve: Rated 175 lb. minimum water pressure, brass or bronze construction, adjustable pressure range threaded connections for 2 in. and less or flanged connections for 2-1/2 in. or larger.
        a. Acceptable Manufacturers:
            1) Apollo/Conbraco
            2) Armstrong
            3) Watts

2.13 GAS PRESSURE REGULATOR

A. Gas Pressure Regulator: Cast iron body, flanged connections, internal relief valve, adjustable spring range setting. See Drawings for size and pressure setting. Relief vent shall be piped to outside.
    1. Acceptable Manufacturers:
        a. Fisher
        b. American
        c. Sprague
        d. Rockwell

2.14 EXCAVATION, BACKFILLING AND COMPACTING

A. Provide excavation, backfilling and compacting in accordance with Division 31 .

2.15 PIPING SPECIALTIES

A. Provide piping specialties in accordance with Section 22 11 19.

2.16 PLUMBING SUPPORTS AND ANCHORS

A. Provide supports and anchors in accordance with Section 22 05 29.

2.17 PLUMBING METERS AND GAUGES

A. Provide meters and gauges in accordance with Section 22 05 19.

2.18 PLUMBING INSULATION

A. Provide mechanical insulation in accordance with Section 22 07 16.

2.19 PLUMBING IDENTIFICATION

A. Provide mechanical identification of all piping systems and valves in accordance with Section 22 05 53.

PART 3 - EXECUTION

3.01 PIPING

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.
D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

E. Route piping in orderly manner and maintain gradient.
F. Install piping to conserve building space and not interfere with use of space.
G. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.
H. Group piping whenever practical at common elevations.
I. Exposed piping, valves, fittings, escutcheons, trim, etc., serving plumbing fixtures in finished areas, shall be polished chromium plated. Exposed piping, valves, fittings, escutcheons, trim, etc., serving plumbing equipment, kitchen equipment, or other equipment located in finished areas, shall be chrome plated, or when not available with chrome plating, they shall be painted with chromium paint.
J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
K. Provide clearance for installation of insulation and access to valves and fittings.
L. Provide access where valves and equipment are not accessible. Coordinate size and location of access doors with applicable Section.
M. Slope water piping and arrange to drain at low points.
N. Establish elevations of buried piping outside the building to ensure not less than 3 ft. of cover.
O. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.
P. Install piping parallel with or at right angles to walls unless otherwise shown on Drawings.
Q. Conceal piping above ceilings, in walls or chases etc., unless otherwise shown or noted on Drawings.
R. Joints in soft copper piping below slab will not be allowed.
S. Soft copper shall not be routed through areas with exposed ceilings except in mechanical rooms.
T. Bending of rigid piping is not permitted; only ells shall be utilized for a change in direction.
U. Temporarily plug or cap open ends of pipe at the end of each workday.
V. Establish invert elevations for drainage piping. Minimum slopes for drainage are 1/4 in. per foot for 3 in. diameter and less and 1/8 in. per ft. for 4 in. diameter pipe and greater.
W. Install bell and spigot pipe with bell end upstream.
X. Trap primer piping shall slope to floor drain at no less than 1/16 in. per ft. Horizontal trap primer piping shall run below floor. Piping in slab is not permitted.
Y. Install vented U-type drain trap on all draw-thru cooling coil drain pans.
Z. All sanitary waste stacks and storm drain down spouts 4 in. diameter and larger with vertical drops over 30 ft. 0 in. shall be provided with joint restraint on the horizontal branch or offset below the vertical drop. Threaded joints, grooved joints or a combination of pipe clamps and tie-rods as required in NFPA 24 shall accomplish joint restraint. Thrust blocks shall accomplish joint restraint below ground as required in NFPA 24. Vertical joint restraint shall be provided from the 90° ell at the bottom of the vertical drop through every joint up to the riser clamp at the floor penetration of the floor above. Horizontal joint restraint shall be provided from that same 90° ell through every joint on the horizontal branch.
AA. Materials exposed within ducts or plenums (ceiling spaces used as supply or return air plenums) shall have a flame-spread index of not more than 25 and a smoke-developed rating of not more than 50 when tested in accordance with the test for Surface Burning Characteristics of Materials, U.B.C. Standard No. 42-1. Do not install any PVC piping in any Return Air Plenums.
BB. Fuel-gas lines and waste cleanouts shall not be located within an air supply plenum.

CC. Piping hangers shall be sized large enough to allow insulation to pass through. Hangers for piping 2-1/2 in. and greater shall be provided with pipe covering protection saddle, or high compressive strength insulation saddle. Hangers for piping 2 in. and less shall be provided with pipe covering shields. On cold or chilled water piping provide vapor barrier through hanger.

DD. Domestic water service piping below building shall be provided with both tie-rod and thrust block restraint in accordance with NFPA 24. Tie-rod restraint shall be provided vertically from the below floor elbow at the base of the riser out to the first hub beyond 5 ft. 0 in. from building. (See NFPA 24-1995 figure A-8-6.2 (b)). Thrust block restraint shall be provided on the below floor elbow at the base of the riser. Area of bearing face of concrete thrust block shall be 32 sq. ft.

EE. Gas piping connections to equipment will be rigid pipe with dirt leg and union. Flexible gas whips will not be allowed.

FF. A pressure reducing valve station shall be furnished and installed on incoming domestic cold water lines with pressure exceeding 80 psi. Furnish valve station with separate strainer.

GG. Roof penetrations through metal roofs by the Plumbing or Mechanical Contractor will be required to have written approval by the Roofing Contractor.

3.02 PIPING CONNECTIONS

A. Threaded Connections

1. Threaded joints shall be in accordance with ANSI B1.20.1. Threaded joints shall be made up Teflon tape or lead free pipe joint compound applied to the male thread only. Should a joint be loosened after being made up, it shall not be made up a second time unless the threads are cleaned and new compound applied.
2. All steel piping which is assembled with screwed joints shall have exposed threads thoroughly primed with a coat of lead free rust resistant paint. Paint immediately after installation. This shall apply to both piping that is to be covered as well as uncovered.

B. Soldered Connections

1. Soldered joints shall be in accordance with ASTM B32. Flux shall be nonacid type. Remove composition discs from solder end valves during soldering. Pipe ends, fittings and valves shall be properly cleaned before soldering and wiped clean to remove flux and excess solder after soldering.

C. Welded Connections

1. Welded joints shall be in accordance with AWS D10.12-79. The oxyacetylene or electric process shall make all joints.
2. Nipples or half couplings welded into the mains will not be accepted. Welded branch connections shall be used to tap mains only where the mains are at least two pipe sizes larger than the branch.
3. All openings cut into pipe for welded outlets shall be accurately made, to give matched intersections. For welded branch outlet fittings, the opening shall be cut before the fittings welded.
4. Long radius type ells shall be on all bends in welded pipelines. No field fabricated or factory segmentally fabricated fittings shall be allowed.
5. Welds on piping shall be cleaned and primed with corrosion resistant paint before insulation is applied or installation is complete.

D. Mechanical Grooved Connections:

1. Pipe shall be prepared and mechanical grooved connections shall be assembled in accordance with ANSI/AWWA C606 and the latest published instructions from the manufacturer.

E. Copper Press Connections:

1. Mechanical copper press fittings shall be made in strict accordance with the manufacturer's installation instructions.
    a. 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(s) approved by the manufacturer.

3.03 FLANGES AND UNIONS

A. Provide flanges and unions at all final connections to equipment, and traps. Arrange piping and piping connections so that equipment being served may be serviced or totally removed without disturbing piping beyond final connections and associated shut-off valves.
B. All flanged connections shall be in accordance with ANSI B16.5 for steel flanges and ANSI B16.1 for cast iron flanges.
C. Bolting shall be in accordance with ASTM A307 Grade B with bolts and nuts in accordance with ANSI B18.2.1 and ANSI B18.2.2.
D. Tighten flange bolts in sequence 180° directly opposite each to equal tension.
E. Flanges and unions shall be made of same material or compatible material as piping systems in which they are installed.

3.04 VALVES

A. Install valves with stems upright or horizontal, not below horizontal.
B. Horizontal swing check valves shall be installed in a true horizontal position. Vertical lift check valves shall be installed in a true vertical position.
C. Install gate valves for shut-off and to isolate equipment, parts of systems, or vertical risers.
D. Install ball valves for throttling, bypass or manual flow control services.
E. Throttling or balancing valves shall be provided with memory stops.

3.05 PRESSURE REDUCING OR REGULATING VALVES

A. Pressure reducing or regulating valves shall be provided with pressure gauges on inlet and outlet side of valve.
B. Adjust pressure reducing or regulating valves for proper outlet pressure and provide valve tag attached to valve body indicating required pressure setting.
C. Gas pressure regulators shall be vented full size or minimum 1/2 in. diameter separately to the outside of the building. Vent outlet shall be a brass 90° cell turned down and covered with brass screen secured to ell with brass wire.
D. Provide shut-off valve ahead of each pressure reducing or regulating valve.

3.06 TESTING

A. General: Furnish pumps, gauges, equipment and personnel required, and test as necessary to demonstrate the integrity of the finished installation.
B. Soil, Waste and Vent, and Storm Drainage: Unless otherwise directed, plug all openings and fill with water to a height equal to the lowest vent or roof drain. Allow to stand one hour or longer as required. Remake leaking joints and retest.
C. Water Lines: Hydrostatically test and make tight at 150 psi. Retain for four hours. Repair all leaking joints and retest.
D. Natural Gas: Pneumatically test and make tight at 1-1/2 times the normal operating pressure and not less than 5 psi. Retain for four hours. Repair all leaking joints and retest.
E. Tests and test procedures shall be witnessed and approved by the Architect.
F. After completion and approval of testing, submit "Test Certificates of Approval" for Sanitary Waste and Vent, Water, Pumped Sewage, Waste, and Drain piping systems stating that all test results are satisfactory. Certificates of approval must be signed by Contractor.

3.07 FLUSHING

A. General: After piping systems have been tested and approved, systems shall be flushed. Furnish compressors, pumps, equipment, personnel, etc. required to flush piping systems.

B. Water Lines: Flush piping with water until water flows clear for a minimum of 60 seconds per 100 linear ft. of piping being flushed at a velocity of 9 ft. per second.

C. Natural Gas: Flush piping with air until air flows clear for a minimum of 60 seconds per 100 linear ft. of piping being flushed at 25 CFM per 1 in. diameter of pipe.

D. All strainers and filters shall be cleaned and replaced prior to start-up.

E. Flushing and flushing procedures shall be witnessed and approved by the Architect.

F. After completion and approval of flushing, submit "Flushing Certificates of Approval" for water and natural gas piping systems stating that all flushing results are satisfactory. Certificates of approval must be signed by Contractor.

3.08 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50-to 80 mg/L residual.

C. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 5 remote outlets.

D. Maintain disinfectant in system for 24 hours.

E. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

F. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

G. Take samples no sooner than 24 hours after flushing, from 5 remote outlets and from water entry, and analyze in accordance with AWWA C651.

H. Disinfection and disinfection procedures shall be witnessed and approved by the Architect.

I. After disinfection is completed, submit "Disinfection Certificate of Approval" for domestic water piping systems to the Architect stating that all test results are satisfactory. Certificate of Approval must be signed by Contractor. Certificate shall show the date, time and residual of each of the following tests:

1. Initial disinfection residual (50 PPM minimum) - 5 samples.
2. Final disinfection residual (25 PPM minimum) - 5 samples.
3. After flushing residual (5 PPM maximum) - 5 samples.
4. Analyze in accordance AWWA C651 - 5 samples.

3.09 CLOSING IN UNINSPECTED WORK

A. Do not cover up or enclose work until it has been properly and completely inspected and approved. Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required. After it has been completely inspected and approved, make all repairs and replacements as necessary to the satisfaction of the Architect, Engineer, and Owner's Representative. Repairs and replacements shall be at no additional cost to the Owner.

END OF SECTION

SECTION 22 10 01
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Extent of Plumbing Specialties Work required by this section is indicated on Drawings and by requirements of this section.

B. Types of Plumbing Specialties specified in this section include the following:

1. Floor drains.
2. Floor sinks.
3. Cleanouts.
4. Backflow preventers.
5. Water hammer arrestors.
6. Trap primers.
7. Thermostatic mixing valves.
8. Special Sanitary waste and vent fittings
9. Dirt legs.

1.02 REFERENCES

A. ANSI/ASSE 1015 - Backflow Preventers, Double Check Principle.

B. ANSI/ASSE 1011 - Hose Connection Vacuum Breakers.

C. ANSI/ASSE 1013 - Backflow Preventers, Reduced Pressure Principle.

D. ANSI A112.21.1 - Floor Drains and Area Drains.

E. ANSI A112.26.1 - Water Hammer Arresters.

F. PDI WH-201 Water Hammer Arresters.

G. NFPA 54 - National Fuel Gas Code, latest edition.

1.03 QUALITY ASSURANCE

A. Conformance with applicable state and local codes and ordinances.

B. Manufacturer: For each product specified, provide components by same manufacturer throughout.

C. Plumbing Certification: Persons performing plumbing work shall have a current Texas State Plumbing License.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable City codes and ordinances and NFPA 54.

1.05 SUBMITTALS

A. Submit product data in accordance with Division 01 and Section 23 00 10.

B. Include component sizes, rough-in requirements, service sizes, and finishes.

C. Submit Certificates as listed below to Architect in accordance with Division 01 and Section 23 00 10.

1. Certificate of Approval - First Heat Tracing System Megohmeter Test.
2. Certificate of Approval - Second Heat Tracing System Megohmeter Test.
3. Certificates of Approval - Backflow Preventers.

PART 2 - PRODUCTS

2.01 FLOOR DRAINS

A. Floor drain: ANSI A112.21.1; cast iron body, double drainage flange, weep holes, bottom outlet, vandal proof secured 6 in. dia. nickel bronze adjustable flat strainer, and non-puncturing flashing collar.

1. Acceptable Manufacturers and Models:

a. Josam Series 30000-6A
b. Smith Series 2010-A
c. Tyler/Wade Series W-1100
d. Zurn Series Z-415
e. Watts Series FD-100-A
f. Mifab Series F1100-C

2.02 FLOOR SINK DRAINS

A. Floor sink drain: ANSI A112.21.1; square cast iron body, double drainage flange, weep holes, bottom outlet, aluminum dome strainer, non-puncturing flashing collar, porcelain enamel or epoxy coated interior, and full grate. Size 12 in. x 12 in. x 8 in.
1. Acceptable Manufacturers and Models:
a. Josam Series 49040
b. Smith Series 3150
c. Tyler/Wade Series W-9140-2
d. Zurn Series ZN-1806
e. Watts Series FS-740
f. Mifab Series FS1730-FL-1

2.03 CLEANOUTS

A. Floor Clean out: Cast iron body, adjustable type, inside caulk connection, standard round nickel bronze top, threaded bronze plug.
1. Acceptable Manufacturers and Models:
a. Josam Series 56000-X-22-15
b. Smith Series 4028C-U
c. Tyler/Wade Series W-6000-IC-5
d. Zurn Series ZN-1400IC-BP-VP
e. Mifab Series C1100X-R
f. Watts Series CO-100-C-RX

B. Wall Clean out: Recessed wall type, cast iron body with threaded bronze plug, flush mounted stainless steel access cover with countersunk center screw and vandal proof secured.
1. Acceptable Manufacturer and Models:
a. Josam Series 58710-15
b. Smith Series 4422C-U
c. Zurn Series Z-1441-BP-VP
d. Mifab Series C1450
e. Watts Series CO-450

C. Wall Clean out: Cast iron clean out tee type with countersunk tapered threaded bronze plug, and stainless steel round access cover with countersunk center screw and vandal proof secured. Provide "T" handle wrench.
1. Acceptable Manufacturers and Models:
a. Josam Series 58790-15
b. Smith Series 4532S-U
c. Zurn Series Z-1446-BP-VP
d. Mifab Series C1460-RD
e. Watts Series CO-460-RD

D. Grade Clean out: Cast iron body, with straight body for caulking into soil pipe hub with countersunk tapered threaded bronze plug, heavy duty access cover, vandal proof. Provide "T" handle wrench.
   1. Acceptable Manufacturers and Models:
      a. Josam Series 58860-15
      b. Smith Series 4253S-U
      c. Zurn Series Z-1474-VP with Z-1449-BP
      d. Mifab Series1300-MF
      e. Watts Series CO-300-MF

2.04 BACKFLOW PREVENTERS

A. Reduced Pressure
   1. Reduced pressure backflow preventer 2 in. and smaller: ANSI/ASSE 1013; complete unit of two independently acting check valves together with an automatically operating pressure relief valve, two ball valves, strainer, and four test cocks, bronze or iron body with bronze internal parts, lead free, 150 psi working pressure, and shall comply with AWWA Standard C506. Devices used in domestic water systems shall be certified "lead free".
      a. Acceptable Manufacturers and Models:
         1) Apollo RP 4A
         2) Watts 009
         3) Wilkins 975XLMS
         4) Mifab FRP
         5) Febco 825Y

B. Backflow Preventer Test Kits
   1. Reduced Pressure Principle Test Kit: Gauge test valves, hoses, adaptors, securing strap, instruction guide and lightweight case.
      a. Acceptable Manufacturer and Model:
         1) Apollo 40-200-TK5U
         2) Watts TK-9-A
         3) Mifab TK

2.05 WATER HAMMER ARRESTORS

A. Water Hammer Arrestors (WHA): ANSI A112.26.1, ASSE 1010, and PDI WH-201; permanently sealed expanding chamber type or bellows type. Sizing symbols indicated on Drawings refer to Plumbing and Drainage Institute “Standard PDI-WH201” established standard classifications. Air chambers are not allowed.
   1. Acceptable Manufacturers and Models:
      a. Expanding Chamber Type
         1) PPP “SC” Series
         2) Sioux Chief "Hydra-Rester" Series
         3) Watts Series 15
         4) Mifab CL/MWH
      b. Bellows Type
         1) Josam 75000-S
         2) J.R. Smith 5000
         3) Tyler/Wade "SHOKSTOP" Series
         4) Watts Series 150A
         5) Zurn Series Z-1700
         6) Mifab WHB

2.06 TRAP PRIMERS

A. Trap Primer: Brass, O-ring seals, with the minimum quantity of distribution units as recommended by manufacturer. Trap primer shall automatically activate and deliver 5 ounces of water on a 15 second 1-psi pressure drop.
   1. Acceptable Manufacturer and Model:
      a. Precision Plumbing Products (PPP)P-1
      b. Mifab M-500

B. Trap Primer: Complete pressure type system for service to multiple floor drains. System shall consist of controller time clock with solenoid valves that will open at a programmed time.
   1. Controller: Programmable, solid state, 6 zone, minimum adjustable run time of 1 minute for each zone, 12 hour program battery backup, 120 VAC to 24 VAC internal transformer, fuse protected circuitry, UL listed, 120 VAC input - 24 VAC output, constructed of enameled steel or plastic.
      a. Acceptable Manufacturers and Models:
         1) Toro Vision 1
         2) Weathermatic LM
         3) Irri-Trol 600
   2. Solenoid Valve: Brass body, buna "N" seats, normally closed, 125 psi rated, 24 VAC.
      a. Acceptable Manufacturers and Models:
         1) Asco 8210
   3. Provide all interconnecting electrical wiring from controller to solenoid valves and accessories required for a complete operable system. All wiring shall be in conduit.

C. Trap Primer shall be chrome plated, an integral part of the water closet flush valve.
   1. Acceptable Manufacturers:
      a. Sloan In-Line Systems

D. Trap Primer Connection Adapter: Cast iron, with 1/2 in. NPT primer tap for use with required drains.
   1. Acceptable Manufacturers and Models:
      a. Josam 88300, 88350, and 88360
      b. Smith 2695, 2696, and 2697
      c. Tyler/Wade W-2400-NH
      d. Zurn Z-1023, Z-1023-1, and Z-1023-2

2.07 THERMOSTATIC MIXING VALVES

A. Thermostatic Mixing Valve Station: Thermostatic type to automatically close hot water port if cold-water pressure fails or close cold-water port if hot water pressure fails, and closes both ports if thermostatic element fails. Valve shall include check valves, stops, and strainers. See Schedule for capacity. Mixing valve shall be installed in a surface mounted or a recessed stainless steel cabinet.
   1. Acceptable Manufacturers and Models:
      a. Powers 430
      b. Leonard TM
      c. Symmons 5-A Series

B. Thermostatic Mixing Valve Station: Duplex high/low flow thermostatic mixing valves with pressure regulating valve to automatically mix hot and cold water to set temperature at high and low water flow conditions. Station shall consist of a large thermostatic mixing valve for high flows, a small thermostatic mixing valve for low flows, regulating valve, pressure gauges, thermometer, and check valve, stop and strainer on each hot and cold water inlet. See Schedule for capacities.
   1. Acceptable Manufacturers and Models:
      a. Powers 430-420-PRV
      b. Leonard TM-186-PRV

C. Remote timer control for thermostatic mixing valve: ____stations, surface mounted stainless steel control cabinet, power switch, station selector switch to transfer temperature readout, spring loaded temperature adjustment switch, temperature discharge meter, solenoid valves, temperature sensors, shocks absorbers, push button activator timers (2-10 min.) with pilot light to indicate timer operation, 115 volt to 24 volt transformer, and 24 volt mixing valve actuator motor.
   1. Acceptable Manufacturers and Models:
      a. Powers 460 Showertrol
      b. Leonard RSC

2.08 SPECIAL SANITARY WASTE AND VENT FITTINGS

A. Special Sanitary Waste and Vent Fittings: Factory fabricated cast iron "No-Hub" drainage waste and vent system engineered for this specific installation by manufacturer's engineers and is acceptable by all local codes. Solvent will not be allowed.
   1. Acceptable Manufacturer and Model:
      a. Tyler Pipe "Rufwall"
      b. Mifab Mi-Hub

2.09 DIRT LEGS

A. Dirt Legs: At each gas connection to apiece of mechanical or plumbing equipment, furnish and install a dirt leg (full size of run out), a 100% shut-off plug valve and union. Do not use flexible gas whips for final connections to equipment.

2.10 EXPANSION TANKS

A. Expansion Tanks: Factory fabricated expansion tanks shall be furnished with each storage-type water heater. Water heaters with 200,000 BTU and larger input capacities or larger than 119 gallons storage shall be furnished with ASME coded expansion tanks.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate cutting of roof construction to receive drains to required invert elevations.

3.02 INSTALLATION AND APPLICATION

A. Install specialties in accordance with manufacturer's instructions to permit intended performance.
B. Extend cleanouts to finished floor or wall surface. Lubricate threaded clean out plugs with mixture of graphite and linseed oil. Ensure clearance at clean out for rodding of drainage system.
C. Trap all drains connected to the sanitary sewer.
D. Install floor and area drains with top depressed 1/2 in. below finished floor elevation.
E. Inlet of overflow drain shall be 2 in. above inlet of adjacent roof drain (or as required by local code).
F. In addition to cleanouts, as shown on the Drawings, Contractor shall provide any additional cleanouts required by local codes and ordinances at no additional cost to the Owner.

G. Outlet of plumbing vents and flues shall be located a minimum of 10 ft. 0 in. from fresh air intakes. Provide offset as required.

H. Relief valve discharge drain from reduced pressure backflow preventers shall be piped full outlet size down to nearest floor drain. Drain line shall terminate above floor drain with air gap.

I. Special sanitary waste and vent fittings shall be designed in accordance with local codes and installed in accordance with manufacturer's shop drawings and installation recommendations.

J. One backflow preventer test kit shall be provided for each type of backflow preventer (Reduced Pressure Principle or Double Check Principle) provided by the Contract Documents.

K. Floor drains that connect into acid waste piping shall be provided with the Manufacturer’s standard acid resistant coating. The coating shall be factory applied to the interior and exterior of the body. Strainer shall not be coated. Field application will not be acceptable. Gasket for the drain connection to the acid waste piping system shall be acid resistant material as recommended by the manufacturer.

L. Pipe Flashing:

1. Open-end dry vent pipes passing through roof waterproofing membrane shall be installed through a 4-pound lead flashing or a 16-ounce copper flashing, each within an integral skirt or flange. Flashing shall be suitably formed, and the skirt or flange shall extend not less than 8 in. from the pipe and shall be set over the roof membrane in a solid coating of bituminous cement. The flashing shall extend up the pipe and turn down into the pipe to form a waterproof joint. The annular space between the flashing and the bare pipe or between the flashing and the metal-jacket-covered insulation shall be sealed with tightly pack fiberglass wool insulation.
2. Closed end pipes passing through roof waterproofing membrane shall be installed through a cast iron sleeve with caulking recess, anchor lugs, flashing-clamp device, pressure ring with brass bolts and deck clamping assembly. Flashing shield shall be fitted into the sleeve-clamping device.

M. Install trap primers on all floor drains unless specifically not required by local codes.

N. All trap primers shall be concealed, within cabinets, walls and/or chases as approved by the Architect. Install access doors at each valve location.

O. Install line size wye-pattern strainer upstream of backflow preventer. Strainer shall be lead free for all potable water systems.

3.03 TESTING

A. Heat tracing systems shall be continuity tested and insulation resistance tested. Contractor shall continuity test each cable after installation. Manufacturer's Representative and Contractor shall Megger test at 2500 volts each heat cable system two times. The first test shall be performed after heat cable installation, but prior to installation of insulation. The second test shall be after installation of insulation but prior to initial start-up. Contractor shall submit certificates of approval to the Architect after each test.

B. Backflow preventers shall be tested for proper operation by the backflow preventer Manufacturer's Representative. The test shall be performed prior to initial start-up. Manufacturer's Representative shall submit certificates of approval to the Architect.

END OF SECTION

SECTION 22 11 19
PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of piping specialties work required by this section is indicated on Drawings and schedules and by requirements of this section.

B. Types of piping specialties specified in this section include the following:
   1. Pipe Escutcheons.
   2. Pipeline Strainers.
   3. Vandal-Proof Vent Caps.
   4. Dielectric Unions.
   5. Mechanical Penetration Seals.
   6. Fire Barrier Penetration Seals.
   7. Drip Pans.
   8. Pipe Sleeves.
   9. Penetration Seals.

C. Piping specialties furnished as part of factory-fabricated equipment, are specified as part of equipment assembly in other Division 22 sections.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of piping specialties of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. FCI Compliance: Test and rate "Y" type strainers in accordance with FCI 73-1 "Pressure Rating Standard for "Y" Type Strainers". Test and rate other type strainers in accordance with FCI 78-1 "Pressure Rating Standard for Pipeline Strainers Other than "Y" Type".

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned Drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of pipeline strainer. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.

B. Shop Drawings: Submit for fabricated specialties, indicating details of fabrication, materials, and method of support.

C. Maintenance Data: Submit maintenance data and spare parts lists for each type of manufactured piping specialty. Include this data, product data, and shop Drawings in maintenance manual; in accordance with requirements of Division 01.

PART 2 - PRODUCTS

2.01 PIPING SPECIALTIES

A. General: Provide factory-fabricated piping specialties recommended by manufacturer for use in service indicated. Provide piping specialties of types and pressure ratings indicated for each service, or if not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections, which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

2.02 PIPE ESCUTCHEONS

A. General: Provide pipe escutcheons as specified herein with inside diameter tightly fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas: Exterior use and interior use including mechanical rooms and any room with water or floor type drains. For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

D. Manufacturer: Subject to compliance with requirements, provide pipe escutcheons of one of the following or approved equal:

1. Chicago Specialty Mfg. Co.
2. Producers Specialty & Mfg. Corp.
3. Sanitary-Dash Mfg. Co.

2.03 LOW PRESSURE Y-TYPE PIPELINE STRAINERS

A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 125 psi working pressure, with Type 304 stainless steel screens, with 3/64 in. perforations @ 233 per sq. in.

B. Threaded Ends, 2 in. and Smaller: Cast-iron body, screwed screen retainer with centered blow down fitted with pipe plug.

C. Threaded Ends, 2+ in. and Larger: Cast-iron body, bolted screen retainer with off-center blow down fitted with pipe plug.

D. Flanged Ends, 2+ in. and Larger: Cast-iron body, bolted screen retainer with off-center blow down fitted with pipe plug.

E. Butt Welded Ends, 2+ in. and Larger: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blow down fitted with pipe plug.

F. Grooved Ends, 2+ in. and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EPDM gasket.

G. Manufacturer: Subject to compliance with requirements, provide low pressure Y-type strainers of one of the following or approved equal:

1. Armstrong Machine Works.
2. Hoffman Specialty ITT; Fluid Handling Div.
3. Metraflex Co.
4. R-P&C Valve; Div. White Consolidated Industries, Inc.
5. Spirax Sarco.
6. Trane Co.
7. Victaulic Co. of America.
8. Watts Regulator Co.

2.04 HIGH PRESSURE Y-TYPE PIPELINE STRAINERS

A. General: Provide strainers full line size of connecting piping, with ends matching piping system materials. Select strainers for 250 psi working pressure, with Type 304 stainless steel screens, with 3/64 in. perforations @ 233 per sq. in.

B. Threaded Ends, 2 in. and Smaller: Cast-iron body, screwed screen retainer with centered blow down fitted with pipe plug.

C. Threaded Ends, 2+ in. and Larger: Cast-iron body, bolted screen retainer with off-center blow down fitted with pipe plug.
D. Flanged Ends, 2+ in. and Larger: Cast-iron body, bolted steel retainer with off-center blow down fitted with pipe plug.
E. Butt Welded Ends, 2+ in. and Larger: Schedule 80 cast carbon steel body, bolted screen retainer with off-center blow down fitted with pipe plug.
F. Manufacturer: Subject to compliance with requirements, provide high-pressure Y-type strainers of one of the following or approved equal:
    1. Armstrong Machine Works.
    2. Hoffman Specialty ITT; Fluid Handling Div.
    3. Metraflex Co.
    4. R-P&C Valve; Div. White Consolidated Industries, Inc.
    5. Spirax Sarco.
    6. Trane Co.
    7. Watts Regulator Co.

2.05 VANDAL PROOF VENT CAPS

A. General: Provide cast-iron vandal-proof vent caps, full size of vent pipe, caulked base connection for cast-iron pipes, threaded base for steel pipes.
B. Manufacturer: Subject to compliance with requirements, provide vandal-proof vent caps of one of the following or approved equal:
    1. Josam Mfg. Co.
    2. Smith (Jay R.) Mfg. Co.
    3. Tyler Pipe; Sub. of Tyler Corp.
    4. Zurn Industries, Inc.; Hydromechanics Div.

2.06 DIELECTRIC UNIONS

A. General: Provide standard products recommended by manufacturer for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.
B. Manufacturer: Subject to compliance with requirements, provide dielectric unions of one of the following or approved equal:
    1. B & K Industries, Inc.
    2. Capital Mfg. Co.; Div. of Harsco Corp.
    3. Eclipse, Inc.
    4. Epco Sales, Inc.
    5. Perfection Corp.
    6. Rockford-Eclipse Div.

2.07 PENETRATION SEALS

A. Caulked Seals: Provide seals for penetrations through interior walls of one of the following:
    1. Mineral Wool or Oakum: Caulked watertight between sleeve and pipe.
B. Mechanical Seals:
    1. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
    2. Manufacturer: Subject to compliance with requirements, provide mechanical sleeve seals of one of the following or approved equal.
        a. Thunderline Corp.

C. Fire Barrier Seals:
   1. Provide seals for any opening through smoke or fire-rated walls, and all above grade floors, used as passage for mechanical components such as piping or ductwork.
   2. Cracks, Voids, or Holes Up to 4 in. Diameter: Use putty or caulking, one-piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL-listed.
   3. Openings 4 in. or Greater: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350°F UL-listed.
   4. Manufacturer: Subject to compliance with requirements, provide fire barrier penetration seals of one of the following or approved equal.
      a. Electro Products Div./3M.
      b. Nelson; Unit of General Signal.

2.08 DRIP PANS

A. General: Provide drip pans fabricated from 20 gauge corrosion-resistant sheet metal with watertight joints, and with edges turned up 2+ in. Reinforce top, either by structural angles or by rolling top over 1/8 in. steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1 in. drain line connection.

2.09 PIPE SLEEVES

A. Provide pipe sleeves of one of the following:
   1. Sheet-Metal: Fabricate from galvanized sheet metal; round tube closed with snap lock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gauges: 3 in. and smaller, 20 gauge; 4 in. to 6 in. 16 gauge; over 6 in., 14 gauge.
   2. Steel-Pipe: Fabricate from Schedule 10 (minimum) steel pipe; remove burrs.
   3. Floor sleeves shall be provided with water stop around perimeter of sleeve.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view; and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surface.

B. Y-Type Strainers: Install Y-type strainers full size of pipeline, in accordance with manufacturer's installation instructions. Install pipe nipple and shutoff valve in strainer blow down connection, full size of connection, except for strainers 2 in. and smaller installed ahead of control valves feeding individual terminals. Where indicated, provide drain line from shutoff valve to plumbing drain, full size of blow down connection.
   1. Locate Y-type strainers in supply line ahead of the following equipment, and elsewhere as indicated, if integral strainer is not included in equipment:
      a. Pumps.
      b. Steam traps serving steam main drips.
      c. Temperature control valves.
      d. Pressure reducing valves.
      e. Temperature or pressure regulating valves.

C. VANDAL PROOF Vent Caps: Install VANDAL PROOF vent caps on each vent pipe passing through roof, and elsewhere as indicated. Locate base of vent cap 6 in. above roof surface, or higher where require by Code.

D. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

E. Mechanical Penetration Seals: Loosely assemble rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.

F. Fire Barrier Penetration Seals: Fill opening with sealing compound. Adhere to manufacturer's installation instructions.

G. Drip Pans: Locate drip pans under piping passing over or within 3 ft. horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1 in. drain line to drain connection, and run to nearest plumbing drain or elsewhere as indicated.

H. Pipe Penetrations: Sleeve new construction or core drill existing construction pipe penetrations as specified below where piping passes through walls, floors, and roofs. Do not penetrate structural members, except as detailed on Drawings, or as reviewed by Architect. Install penetrations accurately centered on pipe runs. Size penetrations so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than two pipe sizes larger than piping run. Where insulation includes vapor-barrier jacket, provide penetration with sufficient clearance for installation. When sleeves are required, install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves two inches above finished floor. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeve. Pipe penetrations shall be as follows:
   1. New floors on grade: Provide sleeved penetrations for all piping except piping two inches and less and waste, drain, and vent piping. Piping not requiring sleeves shall be provided with 30 lb. asphalt saturated roofing felt wrapped around pipe through the thickness of the floor with concrete floor placed up to roofing felt.
   2. New floors above grade: Provide sleeved penetrations for all piping.
   3. Existing Floors Above Grade: Provide core-drilled penetrations for all piping.
   4. New and Existing Walls: Provide sleeved or core drilled penetrations for all piping.
   5. Floor type drains, cleanouts, and water closet waste connections do not require sleeved or core drilled penetrations. Concrete shall be placed tight to connection.
   6. Roof penetrations through metal roofs by the Plumbing or Mechanical Contractor will be required to have written approval by the Roofing Contractor.

I. Pipe Sleeves: Install in accordance with the following:
   1. Install sheet metal on steel pipe sleeves in interior walls.
   2. Install steel pipe sleeves in interior floors above grade.
   3. Install galvanized steel pipe sleeves in floors on grade and in exterior walls above grade and below grade.

J. Penetration Seals:
   1. Install mineral wool/oakum seals as follows:
      a. In interior walls where piping passes from one space to another, where any one of the spaces the piping penetration is not concealed by a ceiling. Caulk penetration watertight.
   2. Install mechanical seals in accordance with manufacturer’s recommendations as follows:
      a. In interior floors on grade.
      b. In interior floors above grade, use three-hour fire rated type only.
      c. In exterior walls above grade and below grade.
      d. In all roof penetrations except vent piping, flue piping, roof or overflow drain piping or any other piping as otherwise detailed on Drawing.

3. Install fire barrier seals in accordance with manufacturer's recommendations as follows:
    a. In all floors above grade, roofs and fire rated walls.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of Plumbing Equipment Work required by this section is indicated on Drawings and Schedules, and by requirements of this section.

B. Types of Plumbing Equipment specified in this section include the following:

1. Domestic water heaters and accessories.
2. Domestic hot water circulation pump.
3. Domestic water softeners and accessories.

1.02 REFERENCES

A. ANSI/ASME Section 8D - Pressure Vessels.

B. ANSI/NFPA 30 - Flammable and Combustible Liquids Code, latest edition.

C. ANSI/NFPA 31 - Installation of Oil Burning Equipment, latest edition.

D. ANSI/NFPA 54 - National Fuel Gas Code, latest edition.

E. ANSI/NFPA 58 - Liquefied Petroleum Gas Code, latest edition.

F. ANSI/NFPA 70 - National Electrical Code, latest edition.

G. ANSI/UL 1453 - Electric Booster and Commercial Storage Tank Water heaters.

1.03 QUALITY ASSURANCE

A. Plumbing Certification: Persons performing plumbing work shall have a current State Plumbing license.

B. Provide pumps with manufacturer's name, model number, and rating/capacity identified.

C. Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. Canadian Standards Association (CSA).
2. National Sanitation Foundation (NSF).
3. American Society of Mechanical Engineers (ASME).
4. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).
5. National Electrical Manufacturers' Association (NEMA).
6. Underwriters Laboratories (UL).

D. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation; operate within 25 percent of midpoint of published maximum efficiency curve.

E. Inspection and certification of water heaters rated 200,000 BTU/HR or over is by Texas Department of Labor and Standards, Boiler Division. Contractor shall have heaters inspected before Owner acceptance of facility and provide the inspection certificate mounted and framed under glass adjacent to the heater.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable City codes and ordinances.

B. Conform to CSA requirements for water heaters.

C. Conform to ANSI/ASME Section 8D for manufacture of pressure vessels for heat exchangers.

D. Conform to ANSI/ASME Section 8D for tanks.

E. Conform to the Texas Department of Labor and Standards; Boiler Division for water heaters rated over 200,000 BTUH.

1.05 SUBMITTALS

A. Submit shop drawings and product data in accordance with Division 01 and Section 22 00 10.

B. Include dimension drawings of water heaters indicating components and connections to other equipment and piping.
C. Include heat exchanger dimensions, size of tappings, and performance data.
D. Include dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tapings, and drains.
E. Indicate pump type, capacity, power requirements, and affected adjacent construction.
F. Submit pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
G. Submit manufacturer's installation instructions of all equipment and accessories in accordance with Division 01 and Section 22 00 10.
H. Submit certificates as listed below to Architect in accordance with Division 01 and Section 22 00 10.
    1. ASME Coded Tank Certificate - Pressure Vessels.
    2. Test Certificates of Approval for plumbing equipment.
    3. Demonstration Certificates of Completion for all plumbing equipment.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data in accordance with Division 01 and Section 22 00 10.
B. Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
C. Include operation, maintenance, and inspection requirements as required by the Department of Labor and Standards, Boiler Division.

1.07 WARRANTY

A. Provide five year manufacturer's non-prorated warranty for domestic water heaters in accordance with Division 01 and Section 22 00 10.

PART 2 - PRODUCTS

2.01 DOMESTIC WATER HEATERS AND ACCESSORIES

A. Gas Water Heaters (Direct Fired)
    1. Domestic water heater: ASHRAE 90.1-2022 energy efficient, commercial natural gas vertical type, interior-lined tank, anode protection, drain valve, ASME safety relief valve, high-temperature cut-off (set at 200°F or 20°F above operating thermostat maximum), operating immersion thermostat (adjustment range 140°F thru 180°F), insulated tank, baked enamel exterior steel jacket, tank inspection port, low water cut-off, UL and AGA approved, and 150 psi working pressure ASME coded tank (for 200,000 BTU and larger models).
        a. Acceptable Manufacturers and Models:
            1) State SBT Series
            2) AO Smith BT Series
            3) Rheem RFD Series
            4) PVI G Series
            5) Lochinvar CRN Series
            6) Bradford White GHE Series
    2. Domestic water heater: ASHRAE 90.1 - 2022 energy efficient, commercial natural gas vertical type, power gas burner, Aquaplex tank, drain valve, ASME safety relief valve, high temperature cut-off (set at 200°F or 20°F above operating thermostat maximum), operating immersion thermostat (adjustment range 140°F thru 180°F), insulated tank, polyethylene exterior jacket, tank inspection port, low water cut-off, ETL listed, 150 psi working pressure, ASME coded tank, direct vent, low NOx.
        a. Acceptable Manufacturers and Models:

1) PVI Conquest
2) No Substitutions

2.02 WATER HEATING SYSTEM ACCESSORIES:

A. Circulation pumps: Inline type, flanged connections, rated for 125 psi at 220°F, single stage, vertical split case, all bronze or stainless steel and provided with oil cups. See Schedule for capacity. Provide with integral timer for IECC compliance.
   1. Acceptable Manufacturers:
      a. Bell & Gossett
      b. Armstrong
      c. Taco
      d. Grundfos

B. Thermostatic control for circulation pumps: Heavy-duty snap-acting SPDT switch, copper constructed liquid filled capillary and bulb sensing element, 100 to 210°F set point adjustment range, 5 to 15°F adjustable differential, 120 VAC, UL listed.
   1. Acceptable Manufacturer and Model:
      a. Barber-Colman Company TC-4112

C. Expansion Tank for Water Heater: Bladder type, full acceptance, fabricated steel shell constructed and stamped per ASME VIII, heavy duty butyl FDA approved removable bladder, 125 psig working pressure, 240°F operating temperature. Tank head shall be galvanized. Pre-charge tank to static pressure of system.
   1. Acceptable Manufacturer and Model:
      a. Elbi DTS Series
      b. Amtrol STC Series
      c. Watts DETA Series
      d. Taco CA Series

D. Condensate Neutralization Kit: Provide manufacture's optional neutralization kit for each high efficiency condensing water heater, or if not available, provide neutralization kit equal to AERCO model 89025. Install multiple kits as required to provide adequate capacity.

2.03 WATER SOFTENERS AND ACCESSORIES

A. Water Softener:
   1. Completely automatic, single type with dry salt storage.
   2. Softener system shall have capacity as scheduled on Drawings.
   3. Softener tank shall be constructed of galvanized steel inside and out with internal baked epoxy lining, designed for 125 psi working pressure. Tank access shall be provided by minimum of 3-1/2 in. hand hole in top head. Lower distribution shall be nonclogging type of plastic construction.
   4. Brine tank shall be constructed of polyethylene with a snug fitting cover. Brine tank shall be provided with a dry salt platform to separate dry salt and concentrated brine.
   5. Regeneration controls shall be fully automatic initiated by either a built-in electric time switch or by an external signal from an automatic reset water meter. Regeneration controls shall include control of backwash and flush flow rates, and have automatic homing feature to prevent controller from getting out of phase in the event of power failure. Cycle shall include automatic start and return to service. Single softener shall allow for automatic bypass of hard water to service during regeneration.
   6. Each softener tank shall be provided with a _____ in. water meter equipped with an automatic reset register.

B. Accessories:

1. Provide a water hardness testing kit with instructions.
2. Acceptable Manufacturers and Models:
    a. Bruner BA Series
    b. Marlo MS Series
    c. Sweney M Series
    d. Aquadyne 1000 Series (Steel softener)

2.04 PIPING SPECIALTIES

A. Provide piping specialties in accordance with Section 22 11 19.

2.05 PLUMBING SUPPORTS AND ANCHORS

A. Provide supports and anchors in accordance with Section 22 05 29.

2.06 PLUMBING METERS AND GAUGES

A. Provide meters and gauges in accordance with Section 22 05 19.

2.07 PLUMBING INSULATION

A. Provide mechanical insulation in accordance with Section 22 07 16.

2.08 PLUMBING IDENTIFICATION

A. Provide mechanical identification of all equipment in accordance with Section 22 05 53.

2.09 PLUMBING VIBRATION ISOLATION

A. Provide vibration isolation in accordance with Section 22 05 48.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment and accessories in accordance with manufacturer's recommendations.
B. Coordinate with heating hot water, electrical work, and gas venting to achieve operational system.
C. Pipe relief valves and drains to nearest floor drain. Provide 1 in. air gap.
D. Install plumbing equipment plumb and square to wall on a 4 in. thick reinforced concrete housekeeping pad.
E. Provide all interconnecting electrical power and control wiring from control panel to equipment and accessories for a complete operable system. All exposed wiring shall be in conduit.
F. Provide line sized shut-off valve and check valve on each sump and sewage pump discharge.
G. Secure control panels and float switches to walls and brackets for proper operation.
H. Coordinate exact location of water heater to insure all required clearances are maintained.

3.02 TESTING

A. Contractor and Manufacturer's Representative shall test water heaters and water softeners including all associated accessories and controls to ensure proper operation.
B. Contractor shall test water heaters and circulation pumps including all associated accessories and controls to ensure proper operation.
C. Tests shall be witnessed and approved by the Architect.
D. After completion and approval of testing, submit "Test Certificate of Approval" for water heaters, circulation pumps, and water softeners including all associated accessories and controls stating that all test results are satisfactory. Certificates of Approval must be signed by the Contractor.

3.03 DEMONSTRATION OF EQUIPMENT

A. Prior to final acceptance, Contractor and Manufacturer's Representative of Domestic Water Heaters and Water Softeners, each shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of the equipment.

B. Prior to final acceptance, Contractor shall provide a minimum of 4 hours (or as long as required by the Owner) to demonstrate to the Owner the proper operation of all the plumbing equipment and associated accessories and controls installed under this section other than the equipment listed above.

C. After completion and approval of demonstrations, submit "Demonstration Certificate of Completion" for domestic water heaters and water softeners including all associated accessories and controls stating that the demonstration of all equipment is satisfactory. Certificates must be signed by the Manufacturer's Representative.

END OF SECTION

SECTION 23 00 10
BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.01 GENERAL PROVISIONS AND SUPPLEMENTAL GENERAL PROVISIONS

A. The "General Conditions" and "Supplementary Conditions" are by reference made a part of this section and shall apply to each and every heading as though included herein.

B. In the event of conflict, the requirements of the "General Conditions" and "Supplementary Conditions" will take precedence over these "General Requirements".

1.02 GENERAL

A. The Contractor shall provide all plans, labor, equipment, appliances and materials, and shall perform all operations in connection with the installation of the mechanical work in accordance with the Specifications, applicable drawings, and the conditions specified above.

B. Contractor shall provide all equipment required and usually furnished in connection with such work and systems whether or not specifically mentioned or specifically indicated on the drawings.

1.03 COMMISSIONING

A. The Contractor shall provide all system commissioning services as required by section C408 of the applicable edition of the International Energy Conservation Code (IECC). Mechanical systems shall comply with IECC section C403.

B. Commissioning, as outlined in IECC section C408 shall include the following:

1. A commissioning plan.
2. Air systems balancing.
3. Functional performance testing for all mechanical equipment, controls and economizers.
4. A preliminary commissioning report.
5. Final documentation including drawings, O&M manual(s), T&B report, and final commissioning report.

C. Per the 2021 IECC the Mechanical System and Service Hot Water System Commissioning is not required when cooling equipment capacity is less than 480,000 Btuh (40 Tons) and the combined Space Heating and Service Hot Water System heating capacity is less than 600,000 Btuh (50 Tons).

1.04 INSPECTION OF THE SITE

A. The Contractor shall visit the site, verifying all existing items indicated on drawings and/or specified, and familiarize himself with the existing work conditions, hazards, grades, actual formations, soil conditions, and local requirements. The submission of bids shall be deemed evidence of such visits.

B. 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.

C. In the event that equipment specified and/or reviewed is not compatible with the existing conditions, the trade furnishing the equipment shall be responsible for notifying the Contractor prior to ordering it.

1.05 PERMITS, UTILITY CONNECTIONS, AND INSPECTIONS

A. Refer to other sections of the specifications for construction phasing and time increments.

B. The Contractor shall obtain and pay for all required utility connections, utility extensions and/or relocations and shall pay all costs and inspection fees for all work included herein.

1.06 APPLICABLE CODES AND STANDARDS

A. The installation shall meet the minimum standards prescribed in the latest editions of the following listed codes and standards, which are made a part of the Specifications, except as may be hereinafter modified in these Specifications and associated drawings.

B. Latest edition of the National Fire Protection Association Standards (NFPA):
   1. NFPA No. 70 National Electrical Code
   2. NFPA No. 90A Installation of Air Conditioning and Ventilating systems
   3. NFPA No. 91 Exhaust systems of Air Conveying of Gases, etc.
   4. NFPA No. 96 Ventilation control and Fire Protection of Commercial Cooking Operations
   5. NFPA No. 101 Safety to Life from Fire in Buildings and Structures
   6. NFPA No. 255 Test of Surface Burning Characteristics of Building Materials

C. United States of America Standards Institute (ASA) Standards:
   1. A40.8 National Plumbing Code
   2. B31.1 & B31.1a Code for Pressure Piping

D. American Society of Mechanical Engineers (ASME): Boiler and Pressure Vessel Codes.

E. Air Conditioning and Refrigeration Institute Standards (ARI): All standards related to refrigeration and air conditioning equipment and piping furnished under these Specifications.

F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) 1985: All applicable manuals and standards.

G. Air Moving and Conditioning Association (AMCA): All applicable manuals and standards.

H. American Society of Testing and Material (ASTM): All applicable manuals and standards.

I. American Water Works Association (AWWA): All applicable manuals and standards.

J. National Electrical Manufacturer's Association (NEMA): All applicable manuals and standards.

K. City Fire Department as applicable to construction of this site.

L. City and State Building Codes.

M. State of (Texas) Occupational Safety Act: Applicable safety standards.

N. Occupational Safety and Health Act (OSHA).

O. State of (Texas) Energy Conservation Construction Code.

P. All work shall be in accordance with all regulations and requirements of the State of Texas Architectural Barriers Act (TAS) and the Americans with Disabilities Act (ADA).

Q. Refer to Specifications sections hereinafter bound for additional codes and standards.

R. All materials and workmanship shall comply with all applicable state and national codes, specifications, and industry standards. All material shall be listed by the Underwriter's Laboratories, Inc., as conforming to its standards and so labeled in every case where such a standard has been established for the particular type of material in question.

S. All equipment provided and all installation methods shall meet all applicable requirements of the International Energy Conservation Code.

T. The Contract Documents are intended to comply with the aforementioned rules and regulations; however, some discrepancies may occur. Where such discrepancies occur, the Contractor shall immediately apply for an interpretation. Should the discovery and notification occur after the execution of a contract, any additional work required for compliance with said regulations shall be paid for as covered by other specifications of the Contract Documents, providing no work or fabrication of materials has been accomplished in a manner of non-compliance. Should the Contractor fabricate and/or install materials and/or workmanship in such a manner that does not comply with the applicable codes, rules and regulations, the Contractor who performed such work shall bear all costs arising in correcting these deficiencies to comply with said rules and regulations.

1.07 CONTRACT DOCUMENTS

A. These specifications are accompanied by drawings of the building and details of the installations indicating the locations of equipment, piping, ductwork, outlets, switch controls, circuits, lines, etc. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.

B. If the Contractor deems any departures from the drawings necessary, details of such departures and the reasons therefore shall be submitted to the Architect for review. No departures shall be made without prior written acceptance.

C. There are intricacies of construction that are impractical to specify or indicate in detail; however, in such cases the current rules of good practice and applicable specifications shall govern.

D. It is the Contractor's responsibility to properly use all information found on the Civil, Architectural, Structural, Mechanical, Plumbing, Fire Protection, and Electrical drawings where such information affects his work.

E. All dimensional information related to new structures should be taken from the appropriate drawings. All dimensional information related to existing facilities shall be taken from actual measurements made by the Contractor on the site.

F. The interrelation of the specifications, the drawings, and the schedules is as follows: The specifications determine the nature and setting of the several materials, the drawings establish the quantities, dimensions and details, and the schedules give the performance characteristics.

G. Should the drawings or specifications disagree within themselves, or with each other, the better quality of greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Architect in writing, shall be performed or furnished. Figures indicated on drawings govern scale measurements and large-scale details govern small-scale drawings.

1.08 SPACE AND EQUIPMENT ARRANGEMENT

A. The size of fire protection, plumbing, mechanical, and electrical equipment indicated on the drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Shop drawings shall be prepared to indicate a suitable arrangement.

B. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

C. Maintain all code required clearances for equipment access.

1.09 FABRICATION DRAWINGS

A. Contractor shall submit shop drawings whenever (1) equipment proposed varies in physical size and arrangement from that indicated on the drawings, thus causing rearrangement of equipment space, (2) where tight spaces require extreme coordination between ductwork, piping, conduit and other equipment, and (3) where called for elsewhere in these specifications.

B. Contractor shall submit ductwork fabrication and hydronic piping shop drawings for review by the Architect. Fabrication drawings shall be fully coordinated with ALL other trades and with existing conditions.

C. All required shop drawings, except as hereinafter specified, shall be prepared at a scale of not less than 1/8 in. equal to 1 ft. for floor plans and 1/4 in. equal to 1 ft. for mechanical rooms.

1.10 SUPERVISION

A. Each contractor shall keep a competent superintendent or foreman on the job at all times necessary for the timely and proper completion of the work.

B. It shall be the responsibility of each superintendent to study all drawings and familiarize himself with the work to be done by other trades. He shall coordinate this work with other trades, and before material is fabricated or installed, make sure that his work will not cause an interference that cannot be resolved without major changes to the drawings. If a conflict between trades arises that cannot be resolved at the jobsite, the matter shall be referred to the Architect for his ruling.

1.11 EXISTING FACILITIES

A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all plumbing, heating, air conditioning, and ventilating services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, and remove all such temporary protection upon completion of the work. All barricades and safety devices shall be in compliance with OSHA.

B. The Contractor shall provide temporary or new services to all existing facilities as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

C. Where existing construction is removed to provide working and extension access to existing utilities, Contractor shall remove doors, piping, conduit, outlet boxes, wiring, light fixtures, air conditioning ductwork and equipment, etc., to provide this access and shall reinstall same upon completion of work in the areas affected.

D. Where partitions, walls, floors, or ceilings of existing construction are indicated to be removed, all Contractors shall remove and reinstall, in locations approved by the Architect, all devices required for the operation of the various systems installed in the existing construction. This is to include, but is not limited to, temperature control system devices, electrical switches, relays, fixtures, piping, conduit, etc.

E. Outages of services, as required by the new installation, will be permitted only at a time approved by the Architect.

1.12 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition.

B. All items that are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed and sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Architect. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas of facilities, which must remain in operation during the construction period, shall not be interrupted without prior specific approval of the Architect as hereinbefore specified.

D. All equipment and materials indicated to be removed and not be re-used shall be disposed of by the Contractor.

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall prepare, in triplicate for the Owner's Manual, complete sets of operating and maintenance instructions, system piping, valving, control and interlock diagrams, manuals, parts lists, etc., for each item of equipment. Include copies of all equipment warranties.

B. In addition, the Contractor shall provide the services of a competent engineer or a technician acceptable to the Architect to instruct a representative of the Owner in the complete and detailed operation of all equipment and systems. These instructions shall be provided for a period of not less than 4 hours to fully accomplish the desired results. Upon completion of these instructions, a letter of release will be required, stating the dates of instruction and the personnel to whom instructions were given. The Contractor shall be responsible for proper maintenance until the instructions have been given to the Owner's maintenance personnel.

1.14 GUARANTEE

A. All work and equipment shall be guaranteed for a period of one year from the date of substantial completion.

B. Guarantee shall be for all labor and materials.

C. Certain items for equipment shall have additional or extended warranties when so specified.

1.15 MATERIALS AND WORKMANSHIP

A. All materials, unless otherwise specified, shall be of current U.S. manufacture, new, free from all defects, and of the best quality of their respective kinds. Materials and equipment shall be installed in accordance with the manufacturer's recommendations and the best standard practice for the type of work involved. All work shall be executed by mechanics skilled in their respective trades, and the installations shall present a neat, workmanlike appearance. Materials, and/or equipment damaged in shipment, or otherwise damaged prior to installation, shall not be repaired at the job site, but shall be replaced with new materials and/or equipment.

B. The responsibility for furnishing the proper equipment and/or material, and to see that it is installed as intended by the manufacturer rests entirely upon the Contractor, who shall request advice and supervisory assistance from the representative of specific manufacturers during the installation.

1.16 FLAME SPREAD PROPERTIES OF MATERIALS

A. Materials and adhesives incorporated in this project shall conform to NFPA 255, latest edition. The classification shall not exceed No. 2, with the range of indices between 0 to 25 for these Classifications as listed in the Federal Specifications. Modifications shall be made to insulating materials, etc., as required to comply with the Federal Specification.

1.17 LARGE APPARATUS

A. Any large piece of apparatus which is to be installed in any space in the building, and which is too large to permit access through stairways, doorways, or shafts shall be brought to the job and placed in the space before the enclosing structure is completed. Following placement in the space, such apparatus shall be thoroughly, completely protected from damage as hereinafter specified.

1.18 FLOOR AND CEILING PLATES

A. Except as otherwise noted, provide chrome plated brass floor and ceiling plates around all pipes, conduits, ducts, etc., passing exposed through walls, floors, or ceilings, in any spaces, except under floor and attic spaces. Plates shall be sized to fit snugly against the outside of the pipe or against the insulation on lines that are insulated and positively secured to such pipe or insulation. Plates will not be required for piping where pipe sleeves extend 3/4 in. above finished floor. All equipment rooms are classified as finished areas. Round and rectangular ducts shall have plates made to fit accurately at all floor, wall and ceiling penetrations.

1.19 SLEEVES, INSERTS AND FASTENINGS

A. Proper openings through floors, walls, roofs, etc., for the passage of piping, ductwork, etc., shall be provided. All penetrations must pass through sleeves except soil pipe installed under concrete slabs on fill. Sleeves shall be set in new construction before concrete is poured, as cutting holes through any part of the concrete will not be permitted unless acceptable to the Architect.

B. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.

C. The minimum clearance between horizontal penetrations including insulation where applicable, and sleeves shall be 1/4 in., except that the minimum clearance shall be 2 in. where piping contacts the ground. Sleeves through walls and partitions shall be installed flush with exposed surfaces. Sleeves through floors shall be extended 2 in. above finished floor.

D. Above grade and dry location sleeves shall be constructed from 20 to 22 gauge galvanized steel. Sleeves passing through walls or floors on or below grade and/or moist areas such as mechanical rooms shall be constructed of galvanized steel Schedule 40 pipe and shall be designed with suitable flange in the center of the floor or wall to form a waterproof passage. After the pipes have been installed in the sleeves, void space around the pipe shall be sealed with "Link-Seal" modular wall and casing seals as manufactured by Thunderline Corporation.

E. Suitable concrete inserts for pipe and equipment hangers shall be set and properly located for all pipe and equipment to be suspended from concrete construction.

F. Fastening of pipes, conduits, etc., in the building shall be as follows: To wood members - by wood screws; to masonry - by threaded metal inserts, metal expansion screws, or toggle bolts, whichever is appropriate for the particular type of masonry; to steel - machine screws or welding (when specifically permitted or directed), or bolts, and to concrete by suitable inserts anchored to reinforcing steel, and poured in place unless other means are acceptable for general use, and will only be permitted where specifically acceptable to the Architect.

G. Under no circumstances will the use of plastic anchors or plastic expansion shields be permitted for any purpose whatsoever.

H. Vermin Proofing: The open space around all ductwork, piping, etc., passing through the ground floor and/or exterior walls shall be sealed with a continuous bead of sealant.

I. The space around piping, ductwork, etc., penetrating walls, ceilings and floors that define air plenums shall be sealed airtight in an acceptable manner. Ceiling plenums used for return air are considered air plenums.

1.20 ACCESS DOORS

A. This Contractor shall provide wall or ceiling access doors for unrestricted access to all concealed shutoff or service valves, strainer, unions, pressure reducing valves, trap primers, water hammer arrestors, heat trace cable junction boxes, and other items of concealed mechanical equipment. All access door locations are not shown on the drawings. It is the Contractor's responsibility to provide access doors at all locations required.

B. Access doors mounted in painted surfaces shall be equal to Milcor (Inland-Ryerson Construction Products Company) manufacture, Style K for plastered surfaces and Style M or DW for non-plastered surfaces. The Style K doors shall be set so that the finished surface of the door is even with the finished surfaces of the adjacent finishes. Access doors mounted on tile surfaces shall be stainless steel materials. Access doors shall be minimum of 18 in. x 18 in. in size.

1.21 CONSTRUCTION REQUIREMENTS

A. The Civil, Architectural, Structural, Fire Protection, Mechanical, Plumbing, and Electrical plans and specifications including the General Provisions, Supplemental General Provisions, and other pertinent documents issued by the Architect, are a part of these specifications and the accompanying mechanical drawings, and shall be complied with in every respect. All the above is included in the Contract Documents, and shall be examined by all bidders. Failure to comply shall not relieve the Contractor of responsibility or be used as a basis for additional compensation due to omission of architectural, structural and electrical details from the mechanical drawings.

B. It is the intent of the Contract Documents to provide an installation complete in every respect. In the event that additional details or special construction may be required for work indicated or specified in this section or work specified in other sections, it shall be the responsibility of the Contractor to provide same as well as to provide material and equipment usually furnished with such systems or required to complete the installation, whether mentioned or not.

C. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation supplied by the manufacturer of the equipment to be installed and thereby to provide an integrated satisfactory operating installation.

D. The mechanical and associated drawings are necessarily diagrammatic in character and cannot show every connection in detail or every pipe or equipment in its exact location. These details are subject to the requirements of ordinances and also structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. Work shall be installed to avoid crippling of structural members; therefore, inserts to accommodate pipe hangers shall be set before concrete is poured, and proper openings through floor, walls, beams, etc., shall be provided as hereinafter specified or as otherwise indicated or required. All work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

E. When the mechanical drawings do not give exact details as to the elevation of pipe, ducts, etc., physically arrange the systems to fit in the space available at the elevations intended with the proper grades for the functioning of the system involved. Piping and duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner, and the plans do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas. Piping specified to be insulated shall be supported in a manner that will allow the insulation to be installed without gaps. Insulated piping in concealed areas shall be offset with fittings as necessary to permit installation of insulation. Bending of pipes or installing pipes in a strain in order to insulate will not be permitted.

F. All oiling devices and all parts of equipment requiring adjustment shall be easily accessible. Equipment shall be so located and installed as to permit convenient and safe maintenance and future replacement. Piping, ductwork, valve stems, etc., shall not block service space.

1.22 MECHANICAL SUBMITTALS

A. Refer to the Conditions of the Contract (General and Supplementary) and Division 01 Section: "SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES" for submittal definitions, requirements, and procedures.

B. Submittal of Shop Drawings, product data, and samples will be accepted only when submitted by The Contractor. Data submitted from Subcontractors and material suppliers directly to the Architect will not be processed.

C. Submit Shop Drawings, product data, and samples on items indicated in the individual sections.

D. Shop Drawings and submittal data shall not be used as requests or proposals for alternate equipment or materials. Refer to Item "Product Options and Substitutions" elsewhere in this section.

E. THIRD PARTY CERTIFICATION: All Packaged equipment shall be independently Third Party labeled as a system for its intended use by a Nationally Recognized Testing Laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR1910.303 and .399, as well as NFPA Pamphlet #70, National Electric Code (NEC), Article 90-7.

1.23 PRODUCT OPTIONS AND SUBSTITUTIONS

A. Refer to the Instructions to Bidders and the Division 01 Section "PRODUCTS AND SUBSTITUTION" for requirements in selecting products and requesting substitutions.

B. Standards for Materials:

1. These specifications indicate a standard for all materials incorporated into the work, with manufacturer's names and catalog numbers used to establish a grade and quality of materials and equipment. The manufacturer listed on the equipment schedules, or named first in the specifications, is the one on whose equipment the layout is based. Other named manufacturers must meet the indicated performance and space requirements.
2. The "approved equal" clause used in these specifications is to permit the proposal of unnamed manufacturer's products for the work, and the Architect decision concerning equal products is final.
3. Considerations as to determination of equal products include, but are not limited to, the following:

Materials	Physical size
Workmanship	Weight
Gauges of Materials	Appearance
Available Local Service Personnel	Performance
Previous successful installations	Capacity
Delivery Schedules	Required Equipment Clearances

C. Requests for substitutions for equipment, materials and apparatus listed in Division 23 Sections must be submitted in writing a **MINIMUM OF 10 DAYS** prior to the scheduled bid date. Such requests must be accompanied by complete data to permit proper evaluation.

D. BIDS SHALL NOT BE BASED ON UN-APPROVED MATERIALS, EQUIPMENT, OR APPARATUS. UNAPPROVED MATERIAL, EQUIPMENT OR APPARATUS WILL NOT BE ACCEPTED.

E. Should electrical, water, drain, natural gas, structural support, or other similar requirements for alternate equipment, whether named in the specifications or approved as a substitution, be different from requirements for the products used in laying out the project, such changes shall be the responsibility of the Contractor, and shall not result in extra charges to the Owner or Architect/Engineer.

1.24 RECORD DOCUMENTS

A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for requirements. The following paragraphs supplement the requirements of Division 01.

B. Mark Drawings to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned for column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.

C. Mark Specifications to indicate approved substitutions; Change Orders; actual equipment and materials used.

1.25 PAINTING

A. Field painting of mechanical equipment, duct systems, piping systems, etc., shall be accomplished under Division 09 of these specifications.

B. Protection of Factory-applied Finishes:

1. Factory-applied finishes on equipment and apparatus installed on the project shall be carefully protected.
2. At the conclusion of the work, and prior to final acceptance of the project, equipment and apparatus shall be thoroughly cleaned of all construction dirt, oil and grease smears, temporary labels, debris, paint droppings, etc.
3. Damaged factory finishes shall be restored to their original condition using procedures, materials and application techniques as set forth in Division 09 found elsewhere in these specifications.

1.26 CLEANING

A. Refer to the Division 01 Section: "CLOSEOUT PROCEDURES" for general requirements for final cleaning.

B. Refer to Division 23 Section: "TESTING, ADJUSTING, AND BALANCING" for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.

C. Name Plates:

1. All nameplates shall be protected from damage during the construction process.
2. At the conclusion of the work, the nameplates shall be carefully cleaned and left in a fully legible condition.

D. Removal of Rubbish: Each Contractor is responsible for the timely removal of rubbish and trash generated by his work, such as empty cartons, containers, materials crates, etc. Particular attention is called to residue that may present a potential tripping or injury hazard.

1.27 MOTORS AND DRIVES

A. Motors:

1. General: Motors shall be U/L-approved, with copper windings, and with a minimum Service Factor of 1.15. The nominal capacity shall exceed the brake horse-power requirements at duty schedules.
2. Motors 1/2 HP and smaller shall be 120-volt, single-phase with internal overload protection.
3. Motors 3/4 HP and larger shall be 208/230 or 460 -volt, 3-phase, unless scheduled or noted otherwise, and shall have thermal over-load cutouts in each phase as recommended by the motor manufacturer.
4. Motors shall be as manufactured by Century, General Electric, US Motors, Wagner, Westinghouse, or approved equal.

B. Drives:

1. Belts drives shall be rated for 150% of motor-rated horsepower.

2. Drive assemblies up to two (2) belts shall have adjustable motor sheaves with the mid-point of the adjustment range at the RPM required for the specified performance.
3. On drive assemblies with 3 or more belts, provide fixed motor sheaves for the specified RPM. Provide and install up to 2 pulley changes as necessary to achieve the required air quantities.
4. All multiple-belt drives shall be factory-marked-matched sets.

C. Specific requirements:
1. Provide high-efficiency motors for the following:
   a. Air-Handling Units, as scheduled.
   b. Ventilating Fans, as scheduled.
   c. HVAC Pumps, as scheduled.
2. Efficiency ranges shall be as follows:

	Nominal HP	Minimum Efficiency	Premium Efficiency
	3	86.5	89.5
	5	87.5	89.5
	7.5	88.5	91.7
	10	89.5	91.7
	15	91.0	92.4
	20	91.0	93.0
	25	91.7	93.6
	30	92.4	93.6
	40	93.0	94.1
	50, 60, 75	93.0, 93.6, 94.1	94.5, 95.0, 95.4
	100	94.1	95.4

3. Motor efficiency certification shall be included with Product Submittal Data in accordance with Division 01 of these specifications.
4. Variable Speed (Frequency) AC Drives:
   a. Where scheduled on the plans, provide and install variable speed (frequency) AC drives for motors.
   b. Variable speed (frequency) AC drives shall be as described in Section 23 89 65 - MOTOR CONTROLLERS - of these Specifications.
5. Motor Starters and Controllers:
   a. Motor starters and controllers for fans, pumps, air-handling units, compressors, etc., which are not provided as an integral part of a factory-assembled package, shall be provided under Division 23 of the specifications. Refer to Section 23 89 65 "MOTOR CONTROLLERS."

PART 2 - PRODUCTS

2.01 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. The manufacturer's published instructions shall be followed for preparing, assembling, installing, erecting, and cleaning manufacturer's materials or equipment, unless otherwise indicated. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such instructions from the Architect, he shall bear all costs arising in connection with the deficiencies.

B. The Contractor shall not receive material or equipment at the jobsite until there is suitable space provided to properly protect equipment from rust, drip, humidity, and dust damage.

C. Capacities shall be not less than those indicated but shall be such that no component or system becomes inoperative or is damaged because of start-up or other overload conditions.

D. Where materials or equipment are specified to be approved, listed, tested, or labeled by the Underwriter's Laboratories, Inc., or constructed and/or tested in accordance with the standards of the American Society of Mechanical Engineers or the Air Moving and Conditioning Association, the Contractor shall submit proof that the items furnished under these sections of the specifications conform to such requirements. The ASME stamp or the AMCA label will be acceptable as sufficient evidence that the items conform to the respective requirements.

E. Each major component of equipment shall have the manufacturer's name, address, and catalog number on a plate securely attached to the item of equipment. All data on nameplates shall be legible at the time of Final Observation.

F. Standard factory finish will be acceptable on equipment specified by model number; otherwise surfaces of ferrous metal shall be given a rust-inhibiting coating. The treatment shall withstand 200 hours in salt-spray fog test, in accordance with Method 6061 of Federal Standard No. 141. Immediately after completion of the test, the specimen shall show no signs of wrinkling or cracking, and no signs of rust creepage beyond 1/8 in. on either side of the scratch mark. Where rust-inhibitor coating is specified hereinafter, any treatment that will pass the above test is acceptable, unless a specific coating is specified, except that coal tar or asphalt type coatings will not be acceptable, unless so stated for a specific item. Where steel is specified to be hot-dip galvanized, mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-pigmented paint conforming to Military Specification MIL-P-6215.

G. Belts, pulleys, chains, gears, couplings, projecting setscrews, keys and other rotating parts located so that any person can come in close proximity thereto, shall be fully enclosed or properly guarded.

H. The Contractor shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, to verify all dimensions in the field, and to advise the Architect of any discrepancy before performing any work. Adjustments to the work required, in order to facilitate a coordinated installation, shall be made at no additional cost to the Owner.

2.02 PROTECTION

A. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.

B. Take particular care not to damage the building structure in performing work. All finished floors, steel treads, and workmen or their tools and equipment shall cover finished surfaces to prevent any damage during the construction of the building.

C. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final observation must be cleaned of rust and repainted as specified elsewhere in these specifications.

2.03 COOPERATION BETWEEN TRADES AND WITH OTHER CONTRACTORS

A. Each trade, subcontractor and/or contractor must work in harmony with the various other trades, subcontractors, and/or contractors on the job as may be required to facilitate the progress to the best advantage of the job as a whole. Each trade, subcontractor, and/or contractor must pursue his work promptly and carefully as not to delay the general progress of the job. This Contractor shall work in harmony with contractors working under other contracts on the premises.

2.04 PRECEDENCE OF MATERIALS

A. These specifications and the accompanying drawings are intended to cover systems which will not interfere with the structural design of the building, which will fit into the available space, and which will insure complete and satisfactory systems. Each Contractor shall be responsible for the proper fitting of his material and apparatus into the building.

B. Each Contractor shall so harmonize his work with that of the other trades so that it may be installed in the most direct and workmanlike manner without hindering or handicapping the other trades. Piping interferences shall be handled by giving precedence to pipelines that require a stated grade for proper operation. Where space requirements conflict, the following order of precedence shall, in general, be observed:

1. Building lines
2. Structural members
3. Soil and drain piping
4. Vent piping
5. Condensate piping
6. Refrigerant piping
7. Electrical bus duct
8. Supply ductwork
9. Return ductwork
10. Exhaust ductwork
11. Chilled water and heating water piping
12. Automatic Fire Protection Sprinkler Piping
13. Natural gas piping
14. Domestic hot and cold water piping
15. Electrical conduit

2.05 LOCATION OF OUTLETS IN ROOMS

A. All fire protection, plumbing, acoustical tile, diffusers, grilles, registers, and other devices shall be referenced to coordinated, established data points and shall be located to present symmetrical arrangements with these points and to facilitate the proper arrangements of acoustical tile panels and other similar panels with respect to the mechanical and electrical outlets and devices. Those mechanical and electrical outlets shall be referenced to such features as wall and ceiling furrings, balanced border widths, masonry joints, etc. Outlets in acoustical tile shall occur symmetrically in tile joints or in the center of whole tiles. When locations of mechanical and electrical devices shown on the Architect reflected ceiling plans need to be modified, the final determination of the exact location of each outlet and the arrangement to be followed shall be acceptable to the Architect.

B. The drawings show diagrammatically the location of the various outlets and apparatus. Exact locations of these outlets and apparatus shall be determined by reference to the general plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with the other trades. The Architect reserves the right to make any reasonable change in location of any outlet or apparatus before installation, without additional cost to the Owner.

C. The Contractor, by submitting a bid on this work, sets forth that he has the necessary technical training and ability, and that he will install his work in a satisfactory and workmanlike manner which is up to the best standards of the trade, complete, and in good working order. If any of the requirements of the drawings and specifications are impossible of performance, or if the installation, when made in accordance with such requirements, will not perform satisfactorily, he shall report it to the Architect for correction promptly after discovery of the discrepancy.

2.06 CONNECTIONS FOR OTHERS

A. This Contractor shall rough-in for and make all gas, water, steam, sewer, etc., connections to all fixtures, equipment, machinery, etc., provided by others in accordance with detailed roughing-in drawings provided by the equipment suppliers, along with actual measurements of the equipment connections, or as detailed.

B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, etc.

C. Provide all air gap fittings where required. In each water line serving an item of equipment or piece of machinery, provide a shut-off valve. On each drain not provided with a trap, provide a suitable trap.

D. All pipefittings, valves, traps, etc., exposed in finished areas and connected to chrome-plated lines provided by others shall be chrome plated to match.

E. Provide all sheet metal ductwork, transition pieces, etc., required for a complete installation of vent hoods, exhaust hoods, etc., provided by others.

2.07 SMOKE DETECTORS

A. The contractor shall for each air handling system with 2000 CFM (nominal 5 Tons) or greater airflow, install UL-listed ionized smoke detectors in the main supply air duct and main return air duct and/or where shown on the drawing. Smoke detectors furnished by Division 26. Refer to Section 23 05 12. Connect the detectors into the control circuit to stop the fan in the event of the presence of smoke.

1. System airflow included the total airflow of all units serving any single space and all units connected to the same return air plenum.

PART 3 - INSTALLATION

3.01 INSTALLATION METHODS

A. All pipes shall be concealed in pipe chases, walls, furred spaces, or above the ceiling, unless otherwise indicated.

B. Piping may be run exposed in mechanical rooms, janitors' closets, or storage spaces, but only where necessary. All exposed piping shall be run in the neatest, most inconspicuous manner, and parallel or perpendicular to the building lines.

C. All piping shall be adequately and properly supported from the building structure by means of hanger rods or clamps to walls as herein specified.

D. Where limited space is available above the ceilings and below concrete beams or other deep projections, pipe and conduit shall be sleeved through the projection where it crosses, in a manner to provide maximum above-floor clearance. Sleeves shall be as specified or as required.

E. All pipe, conduits, etc., shall be cut accurately to measurements established at the building and shall be worked into place without springing or forcing. All ducts, pipes and conduits run, exposed in machinery and equipment rooms, shall be installed parallel to the building plans, except as otherwise shown. Conduits in furred ceilings and in other concealed spaces may be run at angles to the construction but shall be neatly grouped and racked indicating good workmanship. All conduit and pipe openings shall be kept closed until the systems are closed with final connections.

F. There shall be no pipe joints nearer than 12 in. to a wall, ceiling, or floor penetration, unless pipe joint is the welded type joint.

G. The Contractor shall study all construction documents and carefully lay out all work in advance of fabrication and erection in order to meet the requirements of the extremely limited spaces. Where conflicts occur, the Contractor shall meet with all involved trades and the Architect and resolve the conflict, prior to erection of any work, in the area involved.

3.02 CUTTING AND PATCHING

A. Cut and patch openings through walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction.

B. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills at locations acceptable to the Architect. Impact-type equipment will not be used, except where specifically acceptable to the Architect. Openings in Precast concrete slabs for pipes, conduits, outlet boxes, etc., shall be core drilled or cast to exact size.

C. All openings shall be restored to "as-new" condition under the appropriate Specification Section for the materials involved, and shall match remaining surrounding materials and/or finishes.

D. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect.

E. All mechanical work in areas containing plaster shall be completed prior to the application of the finish plaster coat. Cutting of finish plaster coat will not be permitted.

F. No cutting, boring, or excavating, which will weaken the structure, shall be undertaken. NO STRUCTURAL MEMBER MAY BE CUT WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECT.

3.03 ROOF PENETRATIONS AND FLASHING

A. Pipe and duct sleeves and flashings compatible with the roofing installation shall be provided for roof penetrations. Manufacturer of roofing materials shall approve methods and materials. Pitch pans are not acceptable.

B. Roof penetrations through metal roofs by the Plumbing or Mechanical Contractor will be required to have written approval by the Roofing Contractor.

C. Piping penetration flashings shall be specially made for metal roofs and shall be EPDM or neoprene compression molded rubber with corrosion resistant metal base. Flashings shall be by Portals Plus, Inc., Buildex Dektite, or approved equal.

3.04 IDENTIFICATION AND LABELING

A. The Contractor shall make it possible for the personnel operating and maintaining the equipment and systems in this project to readily identify the various pieces of equipment, valves, piping, etc., by marking them.

B. All items of mechanical and electrical equipment shall be identified by the attachment of engraved nameplates constructed from laminated phenolic plastic, at least 1/16 in. thick, 3-ply, with black surfaces and white core. Engraving shall be condensed gothic, at least 1/2 in. high, appropriately spaced. Nomenclature on the label shall include the name of the item, its mark number, area, space, or equipment served, and other pertinent information. Equipment to be labeled shall include, but not be limited to, the following:

1. Rooftop units
2. Exhaust Fans
3. Roof mounted fans
4. Heat Pumps

5. Circulating Pumps
6. Air conditioning control panels and switches
7. Motor controllers
8. Miscellaneous similar and/or related items.

C. The Contractor shall install identification tags to be affixed to those valves that have functions that are not obvious. For example, it would not be expected that valves at a pressure reducing station in a machine room would be tagged. The valve identification tags shall be brass discs, 2 in. in diameter. Each tag shall be attached to its valve with copper clad annealed iron wire or other approved material.

3.05 TESTS AND INSPECTIONS

A. The Contractor shall, during the progress of the work and upon its completion, test his work and make all tests as required by the specifications, state, municipal and other authorities having jurisdiction of the work. Piping pressure tests shall be made before pipe is concealed or covered. Tests shall be made in the presence of authorities requiring tests. The Contractor shall pay all costs, inspection charges and fees required for the tests of his work.

B. The Contractor shall provide all apparatus, temporary piping connection, etc., required for tests. The Contractor shall take all due precautions to prevent damage to the building or its contents incurred by such tests. The Contractor shall repair and make good at his own expense any damage caused by failures or leaks during the tests.

C. Leaks, defects or deficiencies shall be repaired and/or replaced, and tests shall be repeated until the test requirements are complied with fully.

D. All equipment shall be placed in operation and tested for proper automatic control before the final balancing of the system is started.

E. All tests shall have pertinent data logged by the Contractor at the time of testing. Data shall include date, time, personnel, description, and extent of system tested, test condition, test results, specified results, and any other pertinent data. Data shall be delivered to the Architect.

3.06 COOPERATION AND CLEANUP

A. It shall be the responsibility of each trade to cooperate fully with the other trades on the job to help keep the job site in a clean and safe condition. At the end of each day's work, each trade shall properly store all of his tools, equipment and materials and shall clean his debris from the job. Upon the completion of the job, each trade shall immediately remove all of his tools, equipment, any surplus materials and all debris caused by his portion of the work.

3.07 CLEANING AND PAINTING

A. All equipment, piping, ductwork, grills, insulation, etc., in finished areas furnished and installed by the Contractor shall be painted. Finished areas include mechanical rooms, boiler rooms, and outside the building as well as occupied areas inside the building. Final painting is to be done by the General Contractor. This Contractor shall thoroughly clean all part of materials and equipment of cement, plaster, and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with steel brushes to remove rust and other spots and left smooth and clean.

B. This Contractor shall thoroughly clean the finish on all parts of the materials and equipment with factory applied finishes. Exposed parts in equipment rooms, above crawl space slabs, and all other spaces except sealed chases and attics shall be thoroughly cleaned of cement, plaster and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. If the finish has been damaged, the Contractor shall re-paint to the satisfaction of the Architect.

C. All canvas finishes shall be painted with one sizing coat if not already sized, containing a mildew resistant additive and Arabol adhesive prior to any other specified finish paint.

D. No nameplates on equipment shall be painted, and suitable protection shall be afforded to the plates to prevent their being rendered illegible during painting operation.

3.08 ELECTRICAL PROVISIONS OF MECHANICAL WORK

A. The extent of electrical provisions to be provided as mechanical work is indicated in other mechanical sections of the specifications, on the drawings and as further specified in this section.

B. Starters, Controllers: In general, mechanical work includes furnishing combination starters. Controllers are specifically included as electrical work when mounted in motor control centers. Electrical work includes installation, mounting and wiring of starters and controllers that are furnished as mechanical work. Free standing, large motor controllers shall be set in place, on pads, as mechanical work.

C. Electrical heating equipment shall be furnished complete with internal or integral fusing and subdivision of loads to comply with the NEC.

D. Wherever possible, match the elements of the electrical provisions of mechanical work with similar elements of the electrical work specified in electrical sections of the specifications.

E. Standards:

1. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards to definitions of terminology herein.
2. Comply with National Electrical Code (NFPA No. 70) for installation requirements.
3. Comply with National Electrical Contractors Association (NECA) "Standard of Installation".

3.09 TEMPORARY FACILITIES

A. Unless noted otherwise in the Supplementary General Conditions; provide temporary facilities.

3.10 EQUIPMENT INSTALLATION REQUIREMENTS

A. All mechanical equipment shall be furnished and installed complete and ready for use.

B. All mechanical equipment and appliances shall be installed in a manner that all Code required access and services space is provided. Coordinate exact position of equipment and appliances with routing of new ductwork and piping, and with all existing conditions to provide required clearances.

1. Ensure that a minimum of 30” deep and 30” wide working space is provided in front of the control side of each appliance and piece of air moving equipment.
2. Ensure that air moving equipment and appliance in attics are installed so that they also have Code required clear passageway.

C. Others shall furnish certain kitchen, lab, or Owner process equipment. Contractor shall be responsible for furnishing and installing all items as required to make kitchen equipment complete operating systems. The Contractor shall furnish and install all auxiliary piping, valves, controls, control wiring, conduit, alarms, etc., required. All necessary devices, control wiring, conduit, etc., will not necessarily be shown on the drawings.

3.11 EXCAVATION, BACKFILLING AND COMPACTION

A. Excavation:

1. Excavate to the depths required or as indicated.
2. Retain suitable sandy soil for backfilling.
3. Remove excess and non-suitable material.
4. Shore as necessary.
5. Excavate all materials encountered including rock and filled-in material.
6. Form sides where required.

B. Backfilling:
    1. Do not backfill until all tests are complete and approved.
    2. Backfill bottom of trench in 6 in. layers using sandy fill.
    3. Place pipe on minimum bed of 6 in. sand.
    4. Backfill around pipe and minimum of 12 in. above pipe with sand.
C. Compaction:
    1. Compact backfill to 95% maximum density for cohesionless soils.

3.12 OWNER FURNISHED EQUIPMENT

A. The Contractor's responsibility shall include receiving and installing all Owner-furnished equipment.

END OF SECTION

SECTION 23 05 06
MECHANICAL DEMOLITION

PART 1 - GENERAL

1.01 SUMMARY

A. Demolition of:
   1. HVAC air handling units and related ductwork.
   2. Grilles, registers, diffusers, variable air volume boxes.
   3. Natural gas piping.
   4. Refrigerant piping.
   5. Plumbing fixtures and trim, specialties, equipment and associated piping.
   6. Fire protection equipment and associated piping.
   7. Hanger and support devices.
   8. All other appliances or devices associated with equipment or devices to be removed.

B. Demolition of all power wiring and conduit from each mechanical item to be removed back to the point of supply.

1.02 QUALITY ASSURANCE

A. Perform all demolition and removal work necessary to arrive at the arrangement shown on the Contract Drawings.

B. Perform all operations in such a method to cause minimum damage to items to be relocated, salvaged, or to remain intact and in use.

1.03 JOB CONDITIONS

A. Perform site repair and removal of salvaged items at times approved by the Owner. Accomplish repair and removal of items in a continuous and diligent manner in order to limit interference with Owner's on-going operations.

B. Drawings may not indicate and specifications may not identify every item required to be moved or removed.

C. Before submitting bids, visit and examine the site of the work and become familiar with the scope of the work and the details of the demolition work to be accomplished.

D. Submittal of a bid will be evidence that such an examination has been made and the various details noted.

E. Claims for extra compensation because of additional labor, materials, or equipment required because of difficulties encountered, will not be recognized unless items were concealed at time of inspection of the Contract Documents. Bring all such items to the attention of the Owner's Representative and the Architect for their disposition before continuing with the work.

F. Execute demolition work in a manner to protect adjacent equipment and other existing items against damage.

G. Provide and erect lights, barricades, warning signs, and other items as required for protection of the Owner's employees, building occupants, and the public.

H. Maintain barricades in good condition throughout the project to substantial completion.

I. Control the dust resulting from demolition to prevent it from spreading the occupied areas of the building and to avoid creating a nuisance in the immediate surrounding area.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PROTECTION

A. Provide protection for all building elements, all items which are to remain, all occupants and all workers at all times, and in accordance with all requirements of the Owner.

3.02 PROTECTION OF BUILDING FROM THE WEATHER

A. Maintain weather protection for the space(s) being worked in at all times, and in accordance with all requirements of the Owner.

3.03 DEMOLITION

A. Perform demolition in accordance with all requirements of the Owner.

3.04 DISPOSITION OF MATERIALS

A. Dispose of all demolition items and materials in a legal off-site location.

3.05 RELOCATION AND REUSE OF MECHANICAL ITEMS

A. Relocate items indicated on the Contract Drawings as required to accommodate the new construction. Remove, relocate and reconnect equipment and accessories that are to be reused.

B. Coordinate the work with the Electrical Contractor. Determine which items and equipment are to remain, to be relocated or to be removed. Perform the work consistent with the scope of the project.

C. Transport and store materials removed and designated for relocation as directed by the Owner's Representative.

D. Remove all salvage items not be reused or delivered to the Owner, from the property at the end of each workday.

E. Maintain full water, drain, electrical service, etc., to all equipment and apparatus that remains in service in the building.

3.06 CLEANING

A. Section 23 00 10 - Basic Mechanical Requirements.

3.07 REMOVAL OF WATER

A. Be responsible for the removal of water in areas in which scheduled work is to be performed.

1. Remove water by pumping, siphoning, absorbent mopping, or compressed air brooming.
2. Do not use any method of removal that will cause damage to new or reused adjacent equipment or materials.

3.08 SCHEDULING

A. Schedule demolition in strict compliance with the instructions.

3.09 DISCONNECTION AND RECONNECTION OF UTILITIES

A. Do not disconnect or reconnect any utilities until notifying the Owner's Representative.

B. Notify the Electrical Contractor when requiring Electrical Disconnect or Reconnect.

END OF SECTION

SECTION 23 05 12
MECHANICAL AND ELECTRICAL COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
B. Refer to Section 21 00 10 - BASIC FIRE PROTECTION REQUIREMENTS.
C. Refer to Section 22 00 10 - BASIC PLUMBING REQUIREMENTS.
D. Refer to Section 23 00 10 - BASIC MECHANICAL REQUIREMENTS.

1.02 SUMMARY

A. This Section describes the coordination between the Fire Protection, Plumbing, Mechanical and Electrical portions of the work.
B. This Section is included under the Division 21 portion of the Specifications as Section 21 05 12, under the Division 22 portion of the Specifications as Section 22 05 12, under the Division 23 portion of the Specifications as Section 23 05 12, and under the Division 26 portion of the Specifications as Section 26 05 12.

1.03 WORK INCLUDED

A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. **This schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:**

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
1.	Equipment Motors	21/22/23	21/22/23	26
2.	Magnetic Motor Starters			
	a. Automatically controlled, with or without HOA switches	21/22/23	26	Notes 1,3,5
	b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment	21/22/23	22/23	Notes 1,3,5
	c. Manually controlled	21/22/23	26	Notes 1,3,5
	d. Manually controlled and furnished as part of factory wired equipment	21/22/23	26	Notes 1,3,5
	e. Furnished in Motor Control Centers	26	26	Notes 1,3,5
3.	Variable Speed (Frequency) AC Drives	22/23	26	Notes 1,4,5
4.	Line voltage thermostats, time clocks, etc., not connected to control panel systems	23	26	23
5.	Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached	22/23	22/23	22/23

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
	to ducts, pipes, etc.			
6.	Temperature control panels and time switches mounted on temperature control panels	23	23	23
7.	Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc.	23	23	Note 1
8.	Alarm bells furnished with equipment installed by Division 22 or 23	22/23	22/23	22/23
9.	Wiring to obtain power for control circuits, including circuit breaker	21/22/23	21/22/23	21/22/23
10.	Low voltage controls	21/22/23	21/22/23	21/22/23
11.	Fire protection system (sprinkler) controls	21	21	Note 8
12.	Fire and smoke detectors installed on mechanical units and in ductwork	28	23	Note 8
13.	All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment	23	23	Note 1
14.	Smoke dampers, and combination fire/smoke dampers	23	23	Note 7
15.	Boiler and water heater controls, boiler burner controls panels	22/23	22/23	22/23
16.	Pushbutton stations, pilot lights	22/23	22/23	22/23
17.	Heat Tape	21/22/23	21/22/23	26
18.	Disconnect switches, manual operating switches furnished as a part of the equipment	21/22/23	21/22/23	Notes 1,5
19.	Disconnect switches, manual operating switches furnished separate from equipment	26	26	26
20.	Multispeed switches	23	23	26
21.	Thermal overloads	21/22/23	21/22/23	21/22/23
22.	Control relays, transformers	21/22/23	21/22/23	21/22/23
23.	Refrigeration cycle, cooling tower and controls	23	23	23
24.	Tamper switches for fire	21	21	28

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
	protection (sprinkler) system			
25.	Flow and/or pressure switches for fire protection (sprinkler) system	21	21	28
26.	Fire and jockey pump controllers and automatic transfer switch	21	21	Note 6
27.	Alarm bells or horns for fire protection (sprinkler) system	21	21	28
28.	Generator (underground) fuel tank	22	22	--
29.	Generator fuel level indicator	22	22	26
30.	Generator fuel piping from tank to generator	22	22	--
31.	Underground fuel tank leak detection and monitoring system	22	22	22

NOTES:	(1)	Power wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 26; control wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 21/22/23.
	(2)	Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 26 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 specifications, Division 26 and Drawings for more specific requirements.
	(3)	For requirements for Magnetic Motor Starters, refer to Section 23 89 65 - MOTOR CONTROLLERS.
	(4)	For requirements for Variable Speed (Frequency) AC drives, refer to Section 23 89 65 - MOTOR CONTROLLERS.
	(5)	Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.
	(6)	Power wiring from energy source to controllers and automatic transfer switch shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 21, 22 or 23 and conforming to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.
	(7)	Division 26 will provide power to all smoke and combination fire/smoke dampers, and Division 28 will provide control for all such dampers using area smoke detectors.

	(8)	Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

B. CONNECTIONS: Make all connections to controls that are directly attached to ducts, piping and mechanical equipment with flexible connections.

C. PRECEDENCE
   1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.
   2. Precedence for pipe, conduit and duct systems shall be as follows.
      a. Building lines
      b. Structural members
      c. Soil and drain piping
      d. Vent piping
      e. Condensate piping
      f. Refrigerant piping
      g. Electrical bus duct
      h. Supply ductwork
      i. Return ductwork
      j. Exhaust ductwork
      k. Chilled water and heating water piping
      l. Automatic Fire Protection Sprinkler Piping
      m. Natural gas piping
      n. Domestic hot and cold water piping
      o. Electrical conduit
   3. Lighting Fixtures shall have precedence over air grilles and diffusers.

D. FINAL INSPECTION AND REPORT
   1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical Fire Alarm and Temperature Control Contractors, representatives of mechanical and electrical equipment manufactures whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies that they represent, shall be filed with the Owner and Architect or Engineer.

END OF SECTION

SECTION 23 05 29
MECHANICAL SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of supports and anchors required by this section is indicated on Drawings and/or specified in other Division 23 sections.

B. Types of supports and anchors specified in this section include the following:
   1. Pipe and equipment hangers, supports, and anchors.
   2. Equipment bases.

C. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 23 sections.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of supports and anchors, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
   2. Fire Protection Compliance: Install in accordance with NFPA 13-latest edition. Provide products that are UL-listed and FM approved.
   3. MSS Standard Compliance:
      a. Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.
      b. Select and apply pipe hangers and supports, complying with MSS SP-69.
      c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
      d. Terminology used in this section is defined in MSS SP-90.

C. All hangers, supports and attachments shall be manufactured with materials compatible with the environment in which they will be installed. Unless directed otherwise, all hangers, supports, and attachments installed exterior to the building or within high humidity environments shall be galvanized steel or stainless steel.

D. Manufacturers of Hangers and Supports:
   1. Manufacturer: Subject to compliance with requirements, provide hangers and supports of one of the following:
      a. B-Line Systems Inc. (Cooper)
      b. ANVIL International

1.03 SUBMITTALS

A. Submit product data as required under provisions of Division 01 and Section 23 00 10.

B. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

C. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of support and anchor, indicating dimensions, weights, required clearances, and methods of assembly of components.

D. Maintenance Data: Submit maintenance data and parts list for each type of support and anchor. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 01.

PART 2 - PRODUCTS

2.01 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.

B. Adjustable Steel Clevis Hangers: MSS Type 1.

C. Yoke Type Pipe Clamps: MSS Type 2.

D. Steel Double Bolt Pipe Clamps: MSS Type 3.

E. Steel Pipe Clamps: MSS Type 4.

F. Pipe Hangers: MSS Type 5.

G. Adjustable Swivel Pipe Rings: MSS Type 6.

H. Adjustable Steel Band Hangers: MSS Type 7.

I. Adjustable Band Hangers: MSS Type 9.

J. Adjustable Swivel Rings, Band Type: MSS Type 10.

K. Split Pipe Rings: MSS Type 11.

L. Extension Split Pipe Clamps: MSS Type 12.

M. U-Bolts: MSS Type 24.

N. Clips: MSS Type 26.

O. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:

1. Plate: Unguided type.
2. Plate: Guided type.
3. Plate: Hold-down clamp type.

P. Pipe Saddle Supports: MSS Type 36, including steel pipe base-support and cast-iron floor flange.

Q. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.

R. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast-iron floor flange.

S. Single Pipe Rolls: MSS Type 41.

T. Adjustable Roller Hangers: MSS Type 43.

U. Pipe Roll Stands: MSS Type 44.

V. Pipe Rolls and Plates: MSS Type 45.

W. Adjustable Pipe Roll Stands: MSS Type 46.

2.02 VERTICAL-PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory-fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

B. Two-Bolt Riser Clamps: MSS Type 8.

C. Four-Bolt Riser Clamps: MSS Type 42.

2.03 HANGER-ROD ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

B. Steel Turnbuckles: MSS Type 13.

C. Steel Clevises: MSS Type 14.

D. Swivel Turnbuckles: MSS Type 15.

E. Malleable Iron Sockets: MSS Type 16.

F. Steel Weldless Eye Nuts: MSS Type 17.

2.04 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

B. Top Beam C-Clamps: MSS Type 19.

C. Side Beam or Channel Clamps: MSS Type 20.

D. Center Beam Clamps: MSS Type 21.

E. Welded Beam Attachments: MSS Type 22.

F. C-Clamps: MSS Type 23.

G. Top Beam Clamps: MSS Type 25.

H. Side Beam Clamps: MSS Type 27.

I. Steel Beam Clamps W/Eye Nut: MSS Type 28.

J. Linked Steel Clamps W/Eye Nut: MSS Type 29.

K. Malleable Beam Clamps: MSS Type 30.

L. Steel Brackets: One of the following for indicated loading:

1. Light Duty: MSS Type 31, suspending 750 lbs. max.
2. Medium Duty: MSS Type 32, suspending 1500 lbs. max.
3. Heavy Duty: MSS Type 33, suspending 3000 lbs. max.

M. Side Beam Brackets: MSS Type 34.

N. Plate Lugs: MSS Type 57.

O. Horizontal Travelers: MSS Type 58.

2.05 CONCRETE INSERTS

A. Cast-In-Place Spot Type: Malleable iron, or steel with recommended insert nut. Size inserts nut to suit threaded hanger rod. MSS SP-69, Type 18.

B. Drill-In Spot Type: Steel, attached wedge, lock washer and nut. Size inserts to suit threaded hanger rod.

1. Acceptable Manufacturers and Models:
   a. Hilti "Kwik Bolt"
   b. Ramset "Wedge Anchor"
   c. Rawl "Stud"

C. Continuous Channel Type: Steel, anchoring lugs, with channel nuts, rated for 2000 lbs. per foot minimum load. Size channel nut to suit threaded hanger rod.

1. Acceptable Manufacturers and Models:

a. B-Line B22
b. Elcen1150
c. Unistrut P3200

2.06 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Saddles: MSS Type 39; fill interior voids with segments of insulation matching adjoining insulation.

C. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

D. Thermal Hanger Shields: Constructed of 360° insert of high density, 125-psi compressive strength, and water-proofed calcium silicate, encased in 360° sheet metal shield. Provide assembly of same thickness as adjoining insulation.

1. Manufacturer: Subject to compliance with requirements, provide thermal hanger shields of one of the following:
   a. Elcen Metal Products Co.
   b. Pipe Shields, Inc.

2.07 SPRING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory-fabricated spring hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select spring hangers and supports to suit pipe size and loading.

B. Restraint Control Devices: MSS Type 47.

C. Spring Cushion Hangers: MSS Type 48.

D. Spring Cushion Roll Hangers: MSS Type 49.

E. Spring Sway Braces: MSS Type 50.

F. Variable Spring Hangers: MSS Type 51; preset to indicated load and limit variability factor to 25%.

G. Variable Spring Base Supports: MSS Type 52; preset to indicated load and limit variability factor to 25%; include load flange.

H. Variable Spring Trapeze Hangers: MSS Type 53; preset to indicated load and limit variability factor to 25%.

I. Constant Supports: Provide one of the following types, selected to suit piping system. Include auxiliary stops for erection and hydrostatic test, and field load-adjustment capability.

1. Horizontal Type: MSS Type 54.
2. Vertical Type: MSS Type 55.
3. Trapeze Type: MSS Type 56.

2.08 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Cement Grout: Portland cement (ASTM C 150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

D. Auxiliary Steel: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

E. Pipe Guides: Provide factory-fabricated guides, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider bolted tight to pipe. Size guide and spiders to clear pipe and insulation (if any), and cylinder. Provide guides of length recommended by manufacturer to allow indicated travel.

2.09 ROOF EQUIPMENT SUPPORTS

A. General: Construct roof equipment supports using minimum 18 ga. galvanized steel with fully mitered and welded corners, 3 in. cant, internal bulkhead reinforcing, integral base plates, pressure treated wood nailer, and 18 ga. galvanized steel counter flashing.

B. Configuration: Construct of sizes as indicated, compensate for slope in roof so top of support is dead level.

C. Manufacturer: Subject to compliance with requirements, provide roof equipment supports of one of the following:
   1. Pate Co.
   2. Thycurb Div.; Thybar Corp.

2.10 CONCRETE HOUSEKEEPING BASES

A. Concrete housekeeping bases shall be in accordance with Division 3 and constructed of 4,000 psi concrete and reinforced with welded wire fabric in accordance with ASTM A 185 or deformed reinforcing bar in accordance with ASTM A 615, Grade 60.

B. Reinforcement shall be provided for base thickness as follows unless otherwise noted.

	Thickness of Base	Size and Type of Reinforcement	Spacing and Location of Reinforcement
	4 in.	W 2.9 x 2.9 welded	6 in. x 6 in. at centerline of pad
	6 in.	No. 3 bars	18 in. on center each way (3 in. from top of pad
	8 in.	No. 4 bars	18 in. on center each way (3 in. from top of pad)
	12 in.	2 sets of No. 4 bars	Two mats 18 in. on center each way (3 in. from top of pad and 3 in. from bottom of pad)

2.11 SLEEVES, INSETS AND FASTENINGS

A. Pipes passing through concrete or cinder walls and floor or other corrosive material shall be protected by a protective sheathing or wrapping or by sleeves, as required to meet the local code. Annular spaces between sleeves and pipes shall be filled or tightly caulked in an approved manner. Annular spaces between sleeves and pipes in fire-resistance-rated assemblies shall be filled or tightly caulked in accordance with the local code.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which supports and anchors are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachments.

B. Prior to installation of hangers, supports, anchors and associated work, Installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at all changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 psi is indicated, install reinforcing bars through openings at top of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Install additional at concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at all changes in direction of piping. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

C. Support fire-water piping independently of other piping.

D. Prevent electrolysis in support of copper tubing by use of hangers and supports that are copper plated, or by other recognized industry methods.

E. Support and laterally brace vertical pipe runs at every floor level and at intervals not to exceed 20 ft. 0 in. Support vertical pipe with riser clamps installed below hubs, couplings or lugs welded to the pipe.

F. Provisions for Movement:

1. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.
2. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.
3. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

G. Insulated Piping: Comply with the following installation requirements.

1. Clamps: Attach clamps, including spacers (if any), to piping with clamps; do not exceed pipe stresses allowed by ANSI B31.
2. Piping hangers shall be sized large enough to allow insulation to pass through. Hangers for piping 2-1/2 in. and greater shall be provided with pipe covering protection saddle, or high compressive strength insulation saddle. Hangers for piping 2 in. and less shall be provided with pipe covering shields. On cold or chilled water piping provide vapor barrier through hanger.
3. Do NOT utilize "pipe size" hangers or clamps with insulation placed over the pipe and hanger or clamp.

H. Unless directed otherwise, all hangers, supports, and attachments installed exterior to the building or within high humidity environments shall be galvanized steel or stainless steel.

3.05 INSTALLATION OF ANCHORS

A. Install anchors at proper locations to prevent stresses from exceeding those permitted by ANSI B31, and to prevent transfer of loading and stresses to connected equipment.

B. Fabricate and install anchor by welding steel shapes, plates and bars to piping and to structure. Comply with ANSI B31 and with AWS standards.

C. Where expansion compensators are indicated, install anchors in accordance with expansion unit manufacturer's written instructions, to limit movement of piping and forces to maximums recommended by manufacturer for each unit.

D. Anchor spacings: Where not otherwise indicated, install anchors at ends of principal pipe-runs, at intermediate points in pipe-runs between expansion loops and bends. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

3.06 CONCRETE HOUSEKEEPING BASES

A. Concrete housekeeping bases will be provided as work of Division 03. Furnish to Contractor, scaled layouts of all required bases, with dimensions of bases, and location to column centerlines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

B. Provide concrete housekeeping bases for all floor-mounted equipment furnished as part of the work of Division 23 in accordance with Division 03. Size bases to extend minimum of 4 in. beyond equipment base in any direction; and 4 in. above finished floor elevation, unless otherwise noted on Drawing. Construct of reinforced concrete, roughen floor slab beneath base for bond, and provide steel rod anchors between floor and base. Locate anchor bolts using equipment manufacturer's templates. Chamfer top and edge corners.

3.07 EQUIPMENT SUPPORTS

A. Provide structural steel stands to support equipment not floor mounted or hung from structure. Construct of structural steel members or steel pipe and fittings. Provide factory-fabricated tank saddles for tanks mounted on steel stands.

B. Furnish roof equipment supports to Contractor for installation as part of work of Division 07; not work of this section.

3.08 ADJUSTING AND CLEANING

A. Hanger Adjustments: Adjust hangers so as to distribute loads equally on attachments.

B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 23 05 53
MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of mechanical identification work required by this section is indicated on Drawings and/or specified in other Division 23 sections.

B. Types of identification devices specified in this section include the following:
   1. Plastic Duct Markers.
   2. Valve Tags.
   3. Valve Schedule Frames.
   4. Engraved Plastic-Laminate Signs.

C. Mechanical identification furnished as part of factory-fabricated equipment, is specified as part of equipment assembly in other Division 23 sections.

D. Refer to other Division 23 sections for identification requirements at central-station mechanical control center; not work of this section.

E. Refer to Division 26 sections for identification requirements of electrical work; not work of this section.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacturer of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

C. Schedules: Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2 in. x 11 in. bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule. In addition to mounted copies, furnish extra copies for Maintenance Manuals as specified in Division 01.

D. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide mechanical identification materials of one of the following:
   1. Allen Systems, Inc.
   2. Brady (WHO) Co.; Signmark Div.
   3. Industrial Safety Supply Co., Inc.
   4. Seton Name Plate Corp.

2.02 MECHANICAL IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.

2.03 PLASTIC DUCT MARKERS

A. General: Provide manufacturer's standard laminated plastic, color-coded duct markers. Conform to the following color code:
   1. Green: Cold air.
   2. Yellow: Hot air.
   3. Yellow/Green: Supply air.
   4. Blue: Exhaust, outside, return, and mixed air.
   5. For hazardous exhausts, use colors and designs recommended by ANSI A13.1.

B. Nomenclature: Include the following:
   1. Direction of airflow.
   2. Duct service (supply, return, exhaust, etc.).
   3. Duct origin (from).
   4. Duct destination (to).
   5. Design CFM.

2.04 VALVE TAGS

A. Brass Valve Tags: Provide 19-gauge polished brass valve tags with stamp-engraved piping system abbreviation in 1/4 in. high letters and sequenced valve numbers 1/2 in. high, and with 5/32 in. hole for fastener.
   1. Provide 1+ in. diameter tags, except as otherwise indicated.
   2. Provide size and shape as specified or scheduled for each piping system.
   3. Fill tag engraving with black enamel.

B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

C. Access Panel Markers: Provide manufacturer's standard 1/16 in. thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8 in. center hole to allow attachment.

2.05 VALVE SCHEDULE FRAMES

A. General: For each page of valve schedule, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.06 ENGRAVED PLASTIC-LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16 in., except as otherwise indicated.

C. Thickness: 1/8 in., except as otherwise indicated.

D. Thickness: 1/16 in. for units up to 20 sq. in. or 8 in. length; 1/8 in. for larger units.

E. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.07 PLASTICIZED TAGS

A. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, have plasticized card stock with matt finish suitable for writing, approximately 3-1/4 in. x 5-5/8 in., with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples; DANGER, CAUTION, DO NOT OPERATE).

2.08 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in mechanical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
   1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification that indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces that require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 DUCTWORK IDENTIFICATION

A. General: Identify air supply, return, exhaust, intake and relief ductwork with duct markers; or provide stenciled signs and arrows, showing ductwork service and direction of flow, in black or white (whichever provides most contrast with ductwork color).

B. Location: In each space where ductwork is exposed, or concealed only by removable ceiling system, locate signs near points where ductwork originates or continues into concealed enclosures (shaft, underground or similar concealment), and at 50' spacings along exposed runs.

C. Access Doors: Provide duct markers or stenciled signs on each access door in ductwork and housings, indicating purpose of access (to what equipment) and other maintenance and operating instructions, and appropriate safety and procedural information.

D. Concealed Doors: Where access doors are concealed above acoustical ceilings or similar concealment, plasticize tags may be installed for identification in lieu of specified signs, at Installer's option.

3.03 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, HVAC terminal devices and similar rough-in connections of end-use fixtures and units. List each tagged valve in valve schedule for each piping system.
   1. Tagging Schedule: Comply with requirements of "Valve Tagging Schedule" at end of this section.

B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect.
   1. Where more than one major machine room is shown for project, install mounted valve schedule in each major machine room, and repeat only main valves which are to be operated in conjunction with operations of more than single machine room.

3.04 MECHANICAL EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
   1. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
   2. Meters, gauges, thermometers and similar units.
   3. Fans, blowers, primary balancing dampers and mixing boxes.

B. Optional Sign Types: Where lettering larger than 1 in. height is needed for proper identification, because of distance from normal location of required identification, stenciled signs may be provided in lieu of engraved plastic, at Installer's option.

C. Lettering Size: Minimum 1/4 in. high lettering for name of unit where viewing distance is less than 2 ft. 0 in., 1/2 in. high for distances up to 6 ft. 0 in., and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.

D. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

E. Optional Use of Plasticize Tags: At Installer's option, where equipment to be identified is concealed above acoustical ceiling or similar concealment, plasticize tags may be installed within concealed space to reduce amount of text in exposed sign (outside concealment).

3.05 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device, which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

3.06 EXTRA STOCK

A. Furnish minimum of 5% extra stock of each mechanical identification material required, including additional numbered valve tags (not less than 3) for each piping system, additional piping system identification markers, and additional plastic laminate engraving blanks of assorted sizes.
   1. Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in extra stock, along with required stock of stenciling paints and applicators.

END OF SECTION

SECTION 23 05 93
MECHANICAL TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 SUMMARY

A. Adjust and balance Mechanical Air systems

B. Check each piece of operating equipment provided under Division 23.

C. Provide Balancing Report

1.02 QUALITY ASSURANCE

A. Independent Subcontractor: All testing, adjusting and balancing shall be performed by a Testing, Adjusting and Balancing firm that is independent from the HVAC systems installer.

B. Balancing Work: Under direct supervision of AABC accredited testing organization certified supervisor.

1.03 REFERENCES

A. Reference Standards: Comply with AABC National Standards for Total System Balance, latest edition.

1.04 SUBMITTALS

A. Certificate: Before beginning work, submit certification of AABC certified supervisor and AABC firm certification in accordance with Section 23 00 10.

B. Balancing Report: At completion of work, submit balancing report in accordance with Section 23 00 10. After adjustments have been made submit three (3) copies of a complete detailed report on mechanical systems and their operation to include:

1. Blackline prints with air openings marked to correspond with data sheets and with thermometer locations clearly marked.
2. Data sheets showing amount of air handled at each opening, instrument used, velocity readings and manufacturer free area factors.
3. Equipment data sheets giving make, size, etc., of fans, motors and drives. Include supply fans, exhaust and recirculating fans.
4. Operating data including fan RPM, measured motor current and voltage BHP and CFM (total).
5. Equipment and operating data at each section of the unit and at the unit connection points including air temperatures entering and leaving coils (maximum air temperature rise), together with corresponding air flow and air pressure drop, water temperatures entering and leaving coils and/or water pressure drop through coil.
6. Equipment and operating data as required to show performance of H&V units, fan coils, cabinet heaters, unit heaters, temperature control devices, pumps and domestic hot water circulating systems.
7. Static pressure loss across variable air volume boxes and associated reheat coils.
8. Prime source refrigeration equipment operating data at design conditions including temperature measurements, flow conditions and corresponding power consumption.
9. A statement outlining any abnormal or notable conditions not covered in above data. Make special note of any discrepancies between tabulated data and specified conditions.

1.05 PROJECT CONDITIONS

A. Existing Conditions: Verify following conditions before proceeding with work:

1. Installation of the designated system is complete and in full operation.
2. Outside temperature conditions, occupant loads, lighting loads, special equipment requiring extra sensible or ventilation requirements, and solar conditions are within a reasonable range relative to design conditions.

PART 2 - PRODUCTS

2.01 INSTRUMENTS

A. Calibration and maintenance of instruments shall be in accordance with manufacturer's standards and recommendations and requirements of AABC.

B. Calibration histories for each instrument shall be available for examination.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect preceding work in accordance with Section 23 00 10 BASIC MECHANICAL REQUIREMENTS.

3.02 PREPARATION

A. Air Systems: Check:
   1. Filters are clean.
   2. Filter leakage.
   3. Damper operation and leakage.
   4. Duct leakage.
   5. Fan rotation.
   6. Equipment vibration.

3.03 ADJUSTING AND BALANCING

A. General: Check, adjust and balance air system to meet the design performance and tabulate results on acceptable forms. Minimum data to include amperage, voltage input, and thermal heater capacity of each motor, equipment nameplate data and operating speed, pressure drop across each filter bank, pressure rise across each fan and pump, CFM capacity each outlet, zone and fan, and heating or cooling capacity of each coil or element.

B. Belt Drives: Adjust so that when the desired speed and belt tension had been established, the variable speed pulley and the belt tension adjustment shall be at approximately the midpoint of their range.

C. Air Systems:
   1. Adjust dampers and VAV boxes for the delivery and distribution of air quantities indicated on the drawings.
   2. Mark balancing device at final setting.
   3. Replacement of adjustable pulleys, installation of additional balancing dampers or pressure taps, required to effect proper air balance shall be furnished and installed by the HVAC Contractor at no additional cost to the Owner.
   4. Adjust exhaust and recirculation air systems for air quantities indicated on drawings and to establish the proper relationship between supply and exhaust.
   5. Adjust distribution system to obtain uniform space temperature free from objectionable drafts and noise within the capabilities of the system.
   6. Acceptable Tolerances: Adjust fan systems, air devices, etc. as follows:
      a. Supply air fan CFM: -5% to +5% of scheduled
      b. Return air fan CFM: -5% to +5% of scheduled
      c. Exhaust air fan CFM: -0% to +10% of scheduled
      d. Supply air device CFM: -10% to +10% of scheduled
      e. Return air device CFM: -10% to +10% of scheduled
      f. Exhaust air device CFM: -0% to +10% of scheduled
      g. Outside air CFM: -0% to +10% of scheduled

D. Test Run: In order to determine that the system installation is complete and will operate satisfactorily, make a test run with equipment operating per normal temperature control schedule and sequence. Run test and operate and adjust equipment as may be required during test run.

3.04 COMPLETION SERVICES

A. Final Check: Make final checks and do any rebalancing as directed.

B. Report: Submit Balancing Report as specified above.

C. Acceptance: Final acceptance of the project will not be made until a satisfactory report is received. Owner reserves the right to spot check the report by field verification prior to final acceptance.

END OF SECTION

SECTION 23 07 13
HVAC DUCT INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of mechanical insulation required by this section is indicated on Drawings and schedules, and by requirements of this section.

B. Types of mechanical insulation specified in this section include the following:
   1. Ductwork System Insulation:
      a. Fiberglass
      b. UL-Listed Grease Duct Enclosure Insulation System.

C. Refer to Section 23 05 29 - MECHANICAL SUPPORTS AND ANCHORS for protection saddles, protection shields, and thermal hanger shields; not work of this section.

D. Refer to Section 23 31 13 - METAL DUCTWORK for duct linings; not work of this section.

E. Refer to Section 23 05 53 - MECHANICAL IDENTIFICATION for installation of identification devices for piping, ductwork, and equipment; not work of this section.

1.02 REFERENCES

A. NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems.

B. NFPA 90B Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

C. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials.

D. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

E. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials.

F. ASTM E119 Standard Test Method for Fire Tests of Building Construction and Materials.

G. ASTM E136 Standard Test Method for Behavior of materials in a Vertical Tube Furnace at 750ºC.

H. ASTM C177 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

I. ASTM C411 Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.

J. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

K. ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

L. ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

M. ASTM C 916 Standard Specification for Adhesives for Duct Thermal Insulation.

N. ASTM C1071 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).

O. ASTM C1290 Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC.

P. ASTM C1393 Standard Specification for Perpendicularly Oriented Mineral Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.

C. Flame/Smoke Ratings: Provide composite mechanical (insulating material, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (UL723) method.

D. Insulations shall not contain formaldehyde, asbestos, lead, mercury, mercury compounds, or poly-brominated diphenyl ether fire retardants.

E. Fiberglass insulations shall have a minimum of 50 percent recycled glass content; certified and UL Validated.

F. Fiberglass insulations shall have a bio-based, formaldehyde-free binder and be UL GREENGUARD Gold certified.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide fiberglass products of one of the following:

1. Certainteed.
2. Manson.
3. Knauf.
4. Johns Manville.
5. Owens-Corning.

B. Manufacturer: Subject to compliance with requirements, provide grease duct insulation products of one of the following:

1. Morgan Thermal Ceramics.
2. UNIFRAX.
3. 3M.
4. Johns Manville.

2.02 DUCTWORK INSULATION MATERIALS

A. Rigid Fiberglass Ductwork Insulation: ASTM C 612, Type IA.

B. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I

C. Listed Grease Duct Enclosure System: Specifically manufactured duct wrap insulation for grease duct systems, consisting of non-asbestos special fire protection grade ceramic or specially glass blanket. Insulation to comply with ASTM E-119 for one and two-hour rated fire resistive enclosures; ASTM E-136 for non-combustibility. The insulation system shall have been tested and listed by a National Testing Agency. Insulation to have foil-faced jacket on one or two sides.

D. Jackets for Ductwork Insulation: ASTM C 921, Type I (vapor barrier) for ductwork with temperatures below ambient; Type II for ductwork with temperatures above ambient.

E. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

F. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

2.03 METAL PROTECTIVE JACKET

A. Sheet aluminum: ASTM C1729, 3003 alloy, H-14 temper, and 0.016-in. thick. Provide moisture barrier lining for service temperatures 60°F or less except where applied over a Type I or II jacket. Longitudinal lap shall be at least two inches wide.

B. Stainless Steel: ASTM C1767, manufactured from T-304 prime grade Stainless Steels, supplied with a regular dull finish for reduced glare and 0.016-in. thick. These alloys shall be of a soft-annealed temper, for ease in fabrication. Jacketing shall be used for insulated piping, tanks, and vessels less than 8 ft. in diameter. Deep corrugated sheets shall be used for diameters greater than 8 ft. Roll jacketing shall be 3/16 in. corrugated.

C. Fitting covers: Factory fabricated from not lighter than 0.020 in. thick type 3003 sheet aluminum.

D. Bands: 3/4-in. wide aluminum on maximum 18-in. centers.

E. Provide metal jackets over insulation as follows:

1. All insulation exposed to outdoor weather.
2. Insulation exposed in building within five (5) ft. of the floor that connect to sterilizers, kitchen and laundry equipment. Do not penetrate jackets with screws or pop rivets. Provide aluminum angle ring escutcheons at wall, ceiling and floor penetrations.
3. A two-inch overlap is required at longitudinal and circumferential joints.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

B. Thickness of insulation shall be as recommended by the manufacturer for the temperatures and duct sizes involved, and in accordance with standards of NAIMA.

3.02 DUCTWORK SYSTEM INSULATION

A. Insulation Omitted: Do not insulate fibrous glass ductwork or lined ductwork.

B. Dual Temperature Ductwork:

1. Application Requirements: Insulate the following dual temperature ductwork:
   a. Hot/cold supply and return ductwork between fan discharge or HVAC unit discharge and room terminal outlets; except omit insulation on return air ductwork located in return air ceiling plenums.
2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:
   a. Rigid Fiberglass: 1-1/2 in. thick, increase thickness to 2 in. in machine, fan and equipment rooms.
   b. Flexible Fiberglass: 2.2 in. thick, application limited to concealed locations. Flexible insulation will not be used in machine, fan and equipment rooms.

C. Cold Ductwork (Below Ambient Temperature):

1. Application Requirements: Insulate the following cold ductwork:
   a. Outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet.
   b. HVAC supply ductwork between fan discharge, or HVAC unit discharge and room terminal outlet.
   c. Insulate neck and bells of supply diffusers.

d. HVAC return ductwork between room terminal inlet and return fan inlet, or HVAC unit inlet; except omit insulation on return ductwork located in return air-ceiling plenums.
e. HVAC plenums and unit housings not pre-insulated at factory or lined.

2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:
a. Rigid Fiberglass: 2.2 in. thick, increase thickness to 3 in. in machine, fan and equipment rooms.
b. Flexible Fiberglass: 2 in. thick, application limited to concealed locations. Flexible insulation will not be used in machine, fan and equipment rooms.

D. Grease Hood/Range Hood Exhaust Ductwork (Above Ambient Temperature):
1. Application Requirements: Insulate the following hot ductwork:
a. Grease Hood/Range Hood exhaust ductwork.
2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:
a. UL-Listed Grease Duct Enclosures System: 2 in. thick minimum. Thickness to be as required by specific manufacturer as required to achieve a 2 hour rating. Multiple layers of insulation may be used to reach the required rating, if this is a standard and listed application for the specific manufacturer's products.

E. Ductwork insulation density and thickness shall comply with applicable IECC requirements: Minimum installed R-value of 6.0 inside the building envelope, R-value of 8.0 outside the building envelope.

3.03 INSTALLATION OF DUCTWORK INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
B. Install insulation materials with smooth and even surfaces.
C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed to meet IECC requirements.
G. Corner Angles: Except for oven and hood exhaust duct insulation; install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.04 EXISTING INSULATION REPAIR

A. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation of same thickness as existing insulation, install new jacket lapping and sealed over existing.

3.05 PROTECTION AND REPLACEMENT

A. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture-saturated units.
B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 23 09 23
BUILDING CONTROL SYSTEM (BCS)

PART 1 - GENERAL

1.01 GENERAL

A. All work shall be in accordance with Division 01 and Section 23 00 10 "BASIC MECHANICAL REQUIREMENTS".

1.02 SCOPE OF WORK

A. Furnish all labor, materials, tools, equipment, and services to extend the existing fully integrated Building Control System (BCS) as indicated, in accordance with the Contract Documents.

B. The BCS shall fully integrate third-party manufacturers control subsystems (i.e., boilers, chillers, etc.), which shall be capable of operating in a standalone mode, while being software integrated to comprise the complete BCS.

C. Ensure the (E) control system delivers the following features, hardware, and functions as a minimum:

1. Operator Workstation(s) – Complete with Microsoft Windows 7 or newer based operating system.
2. One Network Control Panel (NCP) for each major piece of equipment such as chillers, boilers, cooling towers, etc.
3. One Application Specific Controller (ASC) for each air-handling unit, packaged rooftop unit, make-up air unit, fan coil unit, etc.
4. Integration to third-party manufacturers' microprocessor controllers, as specified herein.
5. Furnish and install all sensors, transducers, and controlled devices per this specification.
6. Furnish all automatic control valves and control dampers for installation by the Mechanical Installer. Furnish and install all control damper and control valve actuators.
7. All monitoring, controlling, optimizing, interfacing, reporting, archiving, operator interface and information formulation and other special packages as required by the Contract Documents, including but not limited to the following:
    a. Scheduled stop/start.
    b. Optimum start/stop.
    c. Run time totalization.
    d. Duty cycling.
    e. Power demand control.
    f. Load restoration following a fire alarm.
    g. Automatic alarm lockout.
    h. Password access control.
    i. Graphics display.
    j. Dynamic graphical trending.
    k. Historical data recording and reporting.

1.03 CONTRACTOR QUALIFICATIONS

A. An integrated BCS will only be considered for acceptance from the following companies:
    1. Existing BCS manufacturer.

B. The BCS shall be installed by competent mechanics and commissioned by competent technicians regularly employed by the equipment vendor.

C. Provide installation, calibration, and check-out of the stand-alone subsystems; as well as the complete operation of the integrated BCS, including graphics generation, implementation of point history feature and energy management applications.

D. Maintain local support facility with technical staff, spare parts inventory, and all necessary test diagnostic equipment.

1.04 REFERENCED STANDARDS, CODES, AND ORDINANCES

A. It is the responsibility of the Contractor to be familiar with all codes, rules, ordinances, and regulations of the authority having jurisdiction and their interpretations that are in effect at the site of the work.

B. All systems equipment, components, accessories, and installation hardware shall be new and free from defects and shall be UL listed where applicable. All components shall be in current production and shall be a standard product of the system or device manufacturer. Refurbished or reconditioned components are unacceptable. Each component shall bear the make, model number, device tag number (if any), and the UL label as applicable. All system components of a given type shall be the product of the same manufacturer.

1.05 SUBMITTALS

A. Provide submittal data as referenced in Division 01 and Section 23 00 10 of these Contract Documents.

B. Shop drawings shall include the installation details for all equipment to be furnished or provided under this Contract. At minimum, the shop drawings shall include details of:
   1. BCS architecture schematic (riser diagram).
   2. Interconnection and installation drawings and schedules, including bill of materials and sequences of operation.
   3. Field panel layout, plan location and interconnection drawings and specification sheets.
   4. Proposed panel loading and spare capacity.
   5. Location and sizes for sleeves in walls and floors.
   6. Instrumentation locations marked on Mechanical Drawings.
   7. Schematic of monitored/controlled systems indicating device locations.
   8. Device installation details.
   9. Other documentation as appropriate.

C. Product data submittals shall include the specifications for all equipment and software to be furnished or provided under this Contract. In addition, the submittals shall include details of:
   1. Software and special packages.
   2. Computer equipment and terminal specification sheets.
   3. Field sensors and instrumentation specification sheets.
   4. Damper, valve and actuator specifications sheets.
   5. Proposed graphic schematics of mechanical and other systems.
   6. Wiring specifications.
   7. Format of point/function log sheet.
   8. Other documentation as appropriate.

PART 2 - PRODUCTS

2.01 GENERAL DESCRIPTION

A. The BCS shall be capable of integrating multiple building functions including equipment supervision and control, alarm management, energy management, lighting control, information management, and historical data collection and archiving as well as trending.

B. The BCS shall consist of the following:
   1. Network Control Panels (NCPs)
   2. Application Specific Controllers (HVAC, TUC, etc.)
   3. Portable Operator Terminals
   4. PC-Based Operator Workstations

C. System shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, Network Control Panels, and operator devices.

D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each NCP and ASC shall operate independently by performing its own specified control, alarm management, operator I/O, and historical data collection as well as trending. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

E. Network Control Panels shall be able to access any data from, or send control commands and alarm reports directly to, any other controller on the network without dependence upon a central processing device, such as a central file server. Network Control Panels shall also be able to send alarm reports to multiple operator workstations, terminals, and printers without dependence upon a central processing device or file server.

2.02 NETWORKING/COMMUNICATIONS

A. The design of the BCS shall network Operator workstations (fixed and portable) and Network Control Panels. Inherent in the system's design shall be the ability to expand or modify the network.

B. Local Area Network

1. Workstation/Network Control Panel Support. Operator workstations and NCPs shall directly reside on a single shared high-speed local area network such that communications may be executed directly between controllers, directly between workstations, and between controllers and workstations on a peer-to-peer basis.
2. Dynamic Data Access. All operator devices, either network resident or connected via the internet, shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the local area network. Access to data shall be based upon logical identification of building equipment.
3. General Network Design. Network design shall include the following provisions:
    a. High-speed data transfer rates for alarm reporting, quick report generation from multiple controllers, and upload/download efficiency between network devices.
    b. Support of any combination of controllers and Operator workstations directly connected to the local area network.
    c. Detection and accommodation of single or multiple failures of workstations, NCP, or the network media. The network shall include provisions for automatically reconfigure itself to allow all operational equipment to perform their designated functions as effectively as possible in the event of single or multiple failures.
    d. Message and alarm buffering to prevent information from being lost.
    e. Error detection, correction, and re-transmission to guarantee data integrity.
    f. Default device definition to prevent loss of alarms or data and to ensure alarms are reported as quickly as possible in the event an operator device does not respond.
    g. Automatic synchronization for the real-time clocks in all NCPs and ASCs shall be provided.

C. Dial-Up Communications. Auto-dial/auto-answer communications shall be provided to allow Network Control Panels to communicate with remote operator devices on an intermittent basis via telephone lines.

1. Dial-Up Network Control Panels. Auto-dial panels shall automatically place calls to workstations to report critical alarms or to upload trend and historical information for archiving. The auto-dial program shall include provisions for handling busy signals, "no-answers," and incomplete data transfers. Default devices shall be called when communications cannot be established with primary devices.

2. Dial-Up Workstations. Operators at dial-up workstations shall be able to perform all control functions, all report functions, and all database generation and modification functions as described for workstations connected via the local area network. Routines shall be provided to automatically answer calls and either file or display information sent from remote NCP.
3. Modem Characteristics. Dial-up communications shall utilize Hayes compatible 56K baud modems and voice or digital grade telephone lines. Each NCP may have its own modem, or a group of NCPs may share a modem.

2.03 NETWORK CONTROL PANELS

A. Network Control Panels shall be microprocessor-based, multi-tasking, multi-user, real-time digital control processors. Each NCP shall consist of modular hardware with plug-in enclosed processors, communication, controllers, power supplies, and input/output modules. A sufficient number of controllers shall be provided to fully meet the requirements of this specification and the attached point list. A 20% installed spare capacity of each point type (AI, AO, DI, DO) shall be provided at each NCP as part of the base bid. The BCS point capacity shall be capable of being expanded by 200% by the addition of NCPs and ASCs. The BCS shall also support an additional two workstations above those specified herein.

B. Each NCP shall have sufficient memory to support its own operating system and databases including:
1. DDC and other control Processes
2. Energy Management Applications
3. Alarm Management
4. Historical/Trend Data for all points
5. Maintenance Support Applications
6. Custom Processes
7. Operator I/O
8. Network Communications
9. Manual Override Monitoring

C. Each NCP shall support the following types of point inputs and outputs:
1. Digital inputs for status/alarm contacts.
2. Digital outputs for on/off equipment control.
3. Analog inputs for temperature, pressure, humidity, flow, and position measurements.
4. Analog outputs for valve and damper modulation, and capacity control of primary equipment.
5. Pulse inputs for pulsed contact monitoring.

D. The BCS shall be modular in nature and shall permit expansion through the addition of software applications, workstation hardware, field controllers, sensors, and actuators. The system architecture shall support 200% expansion capacity of all types of DDC panels and all point types included in the initial installation.

E. Network Control Panels shall provide at least two RS-232C serial data communication ports for simultaneous operation of operator I/O devices such as industry standard printers, laptop workstations, PC workstations, modems and portable operator terminals.

F. Surge and transient protection shall be provided at all network terminations, as well as all field point terminations, to suppress induced voltage transients consistent with UL 1449.

G. In the event of the loss of normal power, there shall be an orderly shutdown of all Network Control Panels to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours. Upon restoration of normal power, the NCP shall automatically resume full operation without manual intervention.

2.04 SYSTEM SOFTWARE FEATURES

A. General
   1. All necessary software to form a complete operating system as described in this specification shall be provided.
   2. The software programs specified in this section shall be provided as an integral part of the NCP or ASC and shall not be dependent upon any higher-level computer for execution.

B. Control Software Description
   1. Control Algorithms. The NCP and ASC shall have the ability to perform the following control algorithms:
      a. Two-Position Control
      b. Proportional Control
      c. Proportional plus Integral Control
      d. Proportional, Integral, plus Derivative Control
      e. Adaptive Control Loop Tuning
   2. Equipment Cycling Protection. Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period. Minimum equipment cycle times shall be coordinated with the equipment manufacturer.
   3. Equipment Delays. The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to electrical loads.
   4. Powerfail Motor Restart. Upon the resumption of normal power, the NCP and ASC panels shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

C. Energy Management Applications
   1. NCP and ASC panels shall have the ability to perform the following energy management routines:
      a. Scheduled stop/start
      b. Optimum start/stop.
      c. Run time totalization.
      d. Duty cycling.
      e. Power demand control.
      f. Night Setback Control.
      g. Enthalpy or Dry Bulb Economizer.
      h. Chilled Water Reset.
      i. Heating/Cooling Interlocks.
      j. Supply Air Temperature Reset.
      k. Hot Water Reset.
   2. All programs shall be executed automatically without the need for operator intervention and shall be flexible to allow operator customization. Programs shall be applied to building equipment as described in the Execution portion of this specification and in the I/O point sheets.

D. Custom Process Programming Capability. NCP and ASC shall be able to execute custom, job-specific processes defined by the operator to automatically perform calculations and special control routines.
   1. Process Inputs and Variables. It shall be possible to use any of the following in a custom process:
      a. Any system-measured point data or status
      b. Any calculated data
      c. Any results from other processes
      d. User-defined constants
      e. Arithmetic functions (+, -, *, /, square root, exponential, etc.)
      f. Boolean logic operators (and, or, exclusive or, etc.)
      g. On-delay/Off-delay/One-shot timers
   2. Process Triggers. Custom processes may be triggered based on any combination of the following:
      a. Time interval
      b. Time of day
      c. Date
      d. Other processes
      e. Time programming
      f. Events (e.g., point alarms)

E. Alarm Management. Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each NCP and ASC shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the NCP or ASC panel's ability to report alarms be affected by either operator activity at a PC workstation or local I/O device, or communications with other controllers on the network.
   1. Point Change Report Description. All alarm or point change reports shall include the point's English language description, and the time and date of occurrence.
   2. Prioritization. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of five priority levels shall be provided.
   3. Report Routing. Alarm reports, messages, and files will be directed to a user-defined list of operator devices or PC disk files used for archiving alarm information. Alarms shall also be automatically directed to a default device in the event a primary device is found to be off-line.
   4. Alarm Messages. In addition to the point's descriptor and the time and date, the user shall be able to print, display, or store an 80-characer alarm message to more fully describe the alarm condition or direct operator response.
   5. Transaction Logging. Operator commands and system events shall be automatically logged to disk in personal computer industry standard database format. Operator commands initiated from direct-connected workstations, dial-up workstations and portable Operator workstation shall all be logged to this transaction file. This data shall be available at the Operator workstation(s).

F. Historical Data and Trend Analysis. A variety of historical data collection utilities shall be provided to automatically sample, store, and display system data in all of the following ways:
   1. Continuous Point Histories. Network Control Panels shall store point history files for all analog and digital points. Sufficient memory shall be provided within each NCP and ASC to accommodate all historical data collection described in this section.

2. The point history routine shall continuously and automatically sample the value of all analog inputs at intervals determined by the Operator. Samples for all points shall be stored for the past 24 hours to allow the user to immediately analyze equipment performance and all problem-related events for the past day. Point history files for all points shall include a continuous record of the last ten status changes or commands for each point.
3. Extended Sample Period Trends. Measured and calculated analog and binary data shall also be assignable to user-definable trends for the purpose of collecting operator-specified performance data over extended periods of time. Sample intervals of 1 minute to 2 hours shall be provided. Each NCP, ASC and portable Operator workstation shall have dedicated memory buffers/hard disk space for trend data.
4. Data Storage and Archiving. Trend data shall be stored at the Network Control Panels and uploaded to hard disk storage when archival is desired.

G. Runtime Totalization. Network Control Panels shall automatically accumulate and store runtime hours for binary input and output points as specified in the Execution portion of this specification.

H. Analog/Pulse Totalization. Network Control Panels shall automatically sample, calculate, and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.

I. Event Totalization. Network Control Panels shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis.

2.05 APPLICATION SPECIFIC CONTROLLERS

A. HVAC Controllers.
1. Each Network Control Panel shall be able to extend its performance and capacity through the use of remote Application Specific Controllers (ASCs).
2. Each ASC shall operate as a standalone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, and real-time digital control processor.
3. Each ASC shall have sufficient memory to support its own operating system and data bases including:
   a. Control Processes
   b. Energy Management Applications
4. The operator interface to any ASC point data or programs shall be through any network-resident PC workstation or portable Operator's workstation connected to any NCP in the network.
5. Powerfail Protection. All system set points, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the controller.
6. Configuration Upload and Download. The ASCs shall have the capability of receiving configuration and program loading by all of the following: 1) locally, via a direct connect portable laptop service tool, 2) over the network, from the portable laptop service tool; and 3) from the Operator Workstation(s), via the communication networks.
7. Continuous Zone Temperature Histories. Application Specific Controllers shall have the capability to automatically and continuously maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored in the ASC or shall be uploaded to the associated NCP or Operator Workstation.

B. Terminal Unit Controllers

1. Provide a terminal unit controller (TUC) for each terminal unit identified on the mechanical drawings.
2. Terminal unit controllers shall comply with the requirements specified above for Application Specific Controllers.
3. The terminal unit manufacturer shall provide the following components to ensure that each terminal unit is provided with a pressure independent control system.
    a. Multi-point flow averaging sensor for primary airflow rate monitoring.
    b. Flow rate calibration curves.
    c. 24 Vac transformer for terminal unit controller power supply.
    d. 24 Vac relay for on/off control of fan (as applicable).
    e. 24 Vac relay(s) for electric heating coil control (as applicable).
    f. Interlocks between the fan motor and the electric heating coil (as applicable).
    g. Manual fan speed adjustment (as applicable).
    h. Sheetmetal DDC controller enclosure.
    i. Terminal unit primary air dampers.
4. Furnish and field install the following terminal unit control components:
    a. Terminal unit DDC controller.
    b. Damper motors for the primary air damper.
    c. Hot water coil control valve (as applicable).
5. Field calibrates the differential pressure transducer used to monitor the terminal unit primary airflow rate. Coordinate calibration with the balancing of the air distribution systems. Ensure overall primary air flow measurement accuracy of +/- 5% for primary air velocities in the range of 400 ft. per minute to 3000 ft. per minute.
6. Control of the primary air dampers and heating coils (electric or hot water, as applicable), shall be by direct digital control using a proportional plus integral control algorithm, at minimum. Maintain the space temperature set point to within +/- 1ºF, when either in the heating or cooling mode.
7. All terminal unit communication cabling shall be routed through cable rings to avoid cable damage due to ductwork, hangers, etc. Communication cabling shall be provided with a heavy insulation jacket and shall be orange or another unique color. Coordinate cable jacket color with all other trades.
8. The sequences of operation shall be resident at the TUC or in the supervisory NCP for the various modes of operations:
    a. Normal occupied mode.
    b. Night setback mode.
    c. Morning warm-up mode.
    d. Morning cool-down mode.
9. The controller shall incorporate the necessary input subsystems to enable monitoring of the following parameters:
    a. Space temperature.
    b. Primary airflow rate. Flow rate shall be displayed at the BCS Operator terminals (including the hand held terminal) in c.f.m.
10. The controller shall incorporate the necessary output subsystems to enable control of the following terminal unit parameters:
    a. Damper modulation. For morning warm-up, terminal unit primary air damper shall be fully closed. For morning cool down the primary air damper shall be open to the maximum flow rate position.

b. Electric heating coil control (where applicable).

2.06 INTEGRATION WITH THIRD-PARTY MANUFACTURER CONTROLLERS

A. Interoperability With Equipment Controllers.
   1. The BCS shall be capable of interoperating with multiple building systems supplied by different manufacturers. The BCS shall be able to receive, react to, and send information from/to multiple equipment controllers.
   2. The system shall allow the custom generation of third-party vendor code on a local level to permit any system to be fully integrated into the BCS network.
   3. Input and output points from the third-party controllers shall have real-time interoperability with BCS software features such as Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and Dial-Up and Local Area Network Communications, as described previously in the contract documents.

B. Networking/Communications.
   1. The BCS shall support any combination of third-party controllers (if more than one third-party manufacturer is being integrated) on a single network.
   2. A minimum of 100 third-party controllers shall be supported on a single network, or as dictated by the third party system architecture.
   3. Integration shall be by RS-232 or RS-485 technologies.

C. Verify and diagnose communication messages and point information between third-party controllers and the BCS.

D. The BCS shall be able to monitor and control third-party controller point inputs and outputs as defined in the I/O point schedule.

2.07 OPERATOR INTERFACE

A. Basic Interface Description.
   1. Operator workstation interface software shall minimize Operator training through the use of English language prompting, English language point identification, and industry standard PC application software. The system shall utilize any one of the following operating systems:
      a. Microsoft Windows
      b. Any system that utilizes a DOS operating system will not be acceptable.
   2. At the option of the user, portable and permanent workstations shall provide consistent graphical or text-based displays of all system point and application data described in this specification. Point identification, engineering units, status indication, and application naming conventions shall be the same at all operator devices.
   3. The Operator Interface shall provide simultaneous viewing of several different types of system displays in a windowing environment to speed facility operation and analysis. For example, the interface shall provide the ability to simultaneously display a graphic depicting an air-handling unit, while displaying the trend graph of several associated space temperatures to allow the user to analyze system performance.
   4. Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display, and data base manipulation capabilities as he deems appropriate for each user, based upon an assigned password.
      a. A minimum of five levels of access shall be supported.
      b. Operators shall be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device, including portable or panel mounted devices, and shall be limited to only those items defined for the access level of the password used to log-on.

c. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving devices on-line.

5. Reports shall be generated automatically or manually and directed to workstation displays, printers, or disk files. As a minimum, the system shall allow the user to easily obtain the following types of reports:
   a. A general listing of all points in the network
   b. List all points currently in alarm
   c. List of all off-line points
   d. List all points currently in override status
   e. List of all disabled points
   f. List all points currently in alarm lockout
   g. List all weekly schedules
   h. List all holiday programming
   i. List of limits and dead bands
6. Third-party interface system data, including transactions, alarms totalization files, etc., shall be stored on the portable workstation disk drive in an industry standard database format (e.g., dBase IV, SQL) such that it is compatible with off-the-shelf third-party database and spreadsheet programs.
7. The BCS shall interface to off-the-shelf personal computer software programs (e.g., Microsoft Word for Windows, Microsoft Excel, Lotus, etc.). This interface shall conform to Dynamic Data Exchange (DDE) protocols and standards. The user shall have the ability to "link" the computer programs directly to live, real-time BCS data values. Systems that offer data exchange using only historical, disk-resident information shall not be acceptable. BCS data value "reads" and "writes" shall both be permissible.

B. Provide Dynamic Color Graphic Displays as follows:
1. System schematics (for each piece of mechanical equipment including air handling units, chilled water systems, and hot water boiler systems).
2. Site plans showing all lighting systems controlled by the BCS.
3. Floor plan of each building floor showing terminal unit and temperature sensor locations. The points displayed on the mechanical system graphic displays shall be based on the I/O point sheets included as part of these Contract Documents.
   a. System Selection/Penetration. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection, or text-based commands.
   b. Dynamic Data Displays. Dynamic temperature values, humidity values, flow values, and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention. Values of each analog output shall be indicated on the associated mechanical system graphic display.
   c. Windowing. The windowing environment of the Operator workstation shall allow the user to simultaneously view several graphics at the same time to analyze total building operation, or allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.

C. System Configuration and Definition. All temperature and equipment control strategies and energy management routines shall be definable by the Operator. System definition and modification procedures shall not interfere with normal system operation and control.

D. Operator Workstation(s):

1. Operator Workstation(s) shall be provided for command entry, information management, network alarm management, and database management functions. All real-time control functions shall be resident in the Network Control Panels and Application Specific Controllers to facilitate greater fault tolerance and reliability.
2. Each Workstation shall be general purpose, commercially available personal computers having the following minimum specifications:
    a. 3 GHZ Pentium Processor
    b. 1 TByte Hard Drive
    c. 8 GByte RAM
    d. 24X CD-Rom
    e. 23 in. 1720 x 1080 LED Monitor
    f. Integral 10/100/1000 Mbaud Networking Interface
    g. Internal 56 KBaud Modem

E. Portable Operator Workstation:
1. Each NCP and ASC shall be capable of supporting a portable notebook Operator workstation or Portable Operator Terminal (POT) for local command entry, instantaneous and historical data display, and program additions and modifications.
2. The operator functions provided by the Portable Workstation shall include, but not be limited to, the following:
    a. Start and Stop Points
    b. Modify Set points
    c. Modify PID Loop Set points
    d. Override PID Control
    e. Change Time/Date
    f. Add/Modify Start/Stop Weekly Scheduling
    g. Add/Modify Set point Weekly Scheduling
    h. Enter Temporary Override Schedules
    i. Define Holiday Schedules
    j. View Analog Limits
    k. Enter/Modify Analog Warning Limits
    l. Enter/Modify Analog Alarm Limits
    m. Enter/Modify Analog Differentials
    n. View Point History Files
3. The Portable Operator Workstation or POT shall provide access to all real or calculated points in the controller to which it is connected (NCP or ASC) or any other controller in the network. This capability shall not be restricted to a set of predefined “global points,” but shall provide totally open exchange of data between the Operator workstation or POT and any controller in the network.
4. Operator access at the Portable Workstation or POT shall be identical to the Operator workstations. Any password changes shall automatically be downloaded to all controllers on the network.
5. The Portable Workstation or POT shall provide English language prompting to eliminate the need for the operator to remember command formats or point names. Prompting shall be provided consistent with a user’s password clearance and the types of points being displayed, to eliminate the possibility of Operator error.

F. Hand Held Terminal
1. Provide two (2) Hand Held Terminals (HHT).

2. The Operator shall be able to execute control and monitoring functions for a terminal unit via plug in connection of the Hand Held Terminal at the TUC and at the wall mounted temperature sensor for that terminal unit. The Operator shall not be required to disconnect the temperature sensor cable to plug the hand Held Terminal into the Terminal unit controller. Provide all required adapter and interfaces required to meet this requirement. It is not a requirement that the Operator be able to undertake monitoring and control functions with the Hand held Terminal on one terminal unit while connected to the control system of another terminal unit control systems are on the same communications network.
3. The Operator shall undertake the following functions for a terminal unit control system from the hand held terminal or POT:
    a. Set terminal unit to occupied mode.
    b. Change occupancy schedules.
    c. Modulate primary air damper to minimum flow rate position.
    d. Modulate primary air damper to closed position.
    e. Modulate primary air damper to maximum flow rate position.
    f. Modulate primary air damper to fully open position.
    g. Change heating space temperature set point.
    h. Change cooling space temperature set point.
    i. Change minimum occupied primary airflow rate.
    j. Change minimum unoccupied primary airflow rate.
    k. Change maximum primary airflow rate.
    l. Change night setback (unoccupied) space temperature set point.
    m. Change control algorithm constants.
    n. Set terminal unit to night setback mode of operation.
    o. Set terminal unit to electrical demand reduction mode.
    p. Set terminal unit to morning warm-up mode.
    q. Set terminal unit to morning cool-down mode.
4. The Operator shall monitor the following parameters with the hand held terminal:
    a. Primary airflow rate in c.f.m.
    b. Space temperature.
5. Handheld tool shall provide English language operator interface.

2.08 INSTRUMENTATION

A. Temperature Sensors/Transducers.
1. Provide only one of the following temperature sensor types throughout:
    a. 1000-ohm, (0.2%) thin film platinum.
    b. 100-ohm, (0.2 ohm) platinum.
    c. 1000-ohm, (0.2%) nickel.
    d. Thermistor (100 or 1000 ohm)
2. All temperature sensors shall be constructed as follows:
    a. Shielded cable with a single end grounded.
    b. Waterproof sensor to sheath seal.
    c. Strain minimizing construction.
3. All sensors provided shall meet the following overall end-to-end accuracy requirements whether or not temperature transducers are provided, under all normal building ambient conditions:
    a. Temperatures less than 100ºF shall be reported by the BCS with an accuracy of 0.5ºF.

b. Temperatures greater than 100ºF shall be reported by the BCS with an accuracy of 1.0ºF.
c. Averaging temperature sensors shall be reported by the BCS with an accuracy of 1.0ºF.
d. Drift shall not exceed the accuracy requirements over a 5-year period.

4. Thermowell mount elements shall meet the following additional requirements.
   a. Stainless steel sheath suitable for the pressure rating of the system.
   b. Length shall be suitable for application.
   c. Furnish thermowells and all other accessories required for the temperature sensor. The Mechanical Installer shall supply Wells for installation. Thermowells shall be stainless steel or chrome plated brass construction of size to suit sensor and pipe and shall be rated for the maximum pressure imposed on the various water systems. Verify and certify that the material of construction will not cause any galvanic corrosion.
   d. Each chilled or hot water supply temperature sensor shall be matched to within 0.2ºF over the range of 32ºF to 68ºF with the associated return water temperature sensor.
5. Outside air temperature sensor shall meet the following additional requirements:
   a. Complete with non-corroding outdoor shield designed to minimize the effect of solar heating on the temperature sensor element.
   b. Water proof seal.
   c. Threaded fittings for mating to conduit.
   d. Outside air temperature sensors shall be wired to different NCP. If one sensor or the associated NCP fails the other shall automatically take its place so that sequences of operation that are dependent on this parameter continue to be executed. Sensors shall be located as approved by the Architect/Engineer.
6. Duct mounted temperature sensors shall meet the following additional requirements:
   a. Copper sheathed construction.
   b. Length shall be such that the element is between 1/3 and 2/3 the distance across the duct from all sides.
   c. Ascertain the recommended location of supply air temperature sensors from the air handling unit manufacturer.
7. Space temperature sensors for non-public spaces shall meet the following additional requirements:
   a. Wall mounted, white protective enclosure. Provide tamper proof cover where installed in public access areas. Wall mounted enclosures shall be subject to Owner's approval where installed in public areas. There shall be no manufacturer's logos, name or thermometer on casing.
   b. The Owner shall select location. No sensor shall be mounted until the Owner gives specific location instructions.
8. Space temperature sensors for all lobbies, public spaces and mullions shall meet the following additional minimum specifications:
   a. Sensor shall be flush mounted button type located as directed by the Owner.
   b. The Owner shall approve color of sensor.
   c. Sensor shall be 1000 ohm RTD or 1000 ohm Balco Resistance and be Barber Colman TS8131 or approved equal.

9. Provide averaging temperature sensors where duct mounted temperature sensors are used to sense mixed air temperature or coil discharge temperature and the cross-sectional area of the duct is 12 square ft. or greater. Averaging temperature sensors shall meet the following requirements:
    a. Copper sheathed construction. Standard conduit box termination. Lead connections shall be rugged.
    b. Probe shall have a minimum-bending radius of 12 in.
    c. Probe shall have a minimum immersion length of 12 ft. or a minimum length of one foot per square foot of duct, whichever is greater.
    d. Probe shall be single continuous sensing RTD or shall be multiple RTD or thermistor sensors spaced no further apart than 6 in.
    e. Provide suitable supports at all bends and elsewhere as necessary to ensure that the sensor is held firmly in position and will not incur damage from vibration in the air stream. Support shall be provided, at minimum, every 24 in. in addition to support at bends.
10. If required, RTD temperature transducers to be provided having the following minimum specifications:
    a. Input circuit to accept resistance detectors as specified above.
    b. Output signal of 4-20mA into maximum of 500-ohm load. Output signal shall be proportional to the engineering range detailed in the Point Sheets.
    c. Output short circuit and open circuit protection.
    d. Input short circuit and open circuit protection.
    e. Output variation of less than 0.2% of full-scale output for supply voltage variations of 10%.
    f. Combined non-linearity, repeatability and hysterisis effects not to exceed 0.5% of full-scale output.
    g. Maximum current to sensor not to exceed manufacturers suggested rating.
    h. Integral, accessible zero and span adjustments.
    i. Long term output drift of equal to or less than 0.50% of full-scale output per year.
    j. Shock and vibration protection as necessary.

B. Humidity Sensors/Transducers
1. Provide outside air, space and duct mounted relative humidity sensors and transducers having the following minimum specifications:
    a. Range of 0 - 100% RH.
    b. Combined “end-to-end” accuracy of sensor and transducer, 5% RH between 20% and 80% RH and 6% RH over full range.
    c. Maximum sensor non-linearity of 5% RH with defined curve. Transducer to provide linearized output.
    d. Output from transducer shall be 4-20 mA into a maximum of 500-ohm load.
    e. Output variations of less than 0.2% of full-scale output for supply variations of 10%.
    f. Maximum output linearity error of 1% if full scale output.
    g. Integral accessible zero and span adjustments.
    h. Long term output drift of less than 0.25% of full-scale output per 6 months.
    i. Dustproof housing.
    j. Outside air sensor shall be complete with non-corroding outdoor shield designed to minimize the effect of wind or solar heating on the RH sensing element (outdoor only).

k. Suitably sized conduit to be provided for any lead wires external to the building or passing through the wall of the building (outdoor only).
l. Duct mounted sensor shall have a minimum 8 in. probe.

C. Control Relays
1. Provide interposing control relays having, at minimum, the following specifications:
a. Pickup rating time and hold rating as required for individual applications.
b. Input operating voltage to be compatible with the BCS digital output equipment.
c. Shock and vibration protection as necessary.
d. Rated for a minimum of ten (10 million mechanical operations and a minimum of 500,000 electrical operations.
2. The control relays shall be located in the NCP or other local panels as provided by the BCS Installer.
3. The relays shall provide complete isolation between the motor starter, damper actuator or valve actuator, control circuit and the associated BCS digital output.
4. Select control relays such that they meet the following requirements.
a. The malfunction of an NCP/ASC component shall cause the motor to fail on or off or maintain previous status as identified in the Sequences of Operation.
b. Following the resumption of power after power interruption to a motor, the motor shall not restart until commanded to do so by the BCS in accordance with a predetermined start-up procedure.
c. If a motor is detected by the BCS to have failed, i.e. its BCS monitored and commanded status differ, then the BCS shall shut down the motor and restart shall only be possible (when the HOA switch is in the “Auto”) by a manually entered restart command at the BCS.
5. Where hand-off-auto (HOA) switches are provided, the BCS digital output shall be wired such that control of the motor is from the BCS in the auto position only.
6. Other interlocks providing safety control, e.g. shutdown on high temperature/vibration detection, etc., shall not be overridden by the BCS control relays or the installation of the control relays.

D. Differential Pressure Transducer - Air Service
1. Provide supply static differential pressure transducers as follows:
a. Pressure transducers shall monitor the difference supply duct static pressure and space static pressure. The sensing point in the duct shall be as identified in the sequences of operations. The sensor shall be mounted adjacent to the sensing point in the duct.
b. Internal materials of the transducer shall be suitable for the application.
c. Output signal of 4-20mA proportional to input pressure, into a 500 ohm load.
d. Input range of 0 to 5 in.
e. Output variations of less than 0.3% full scale for supply voltage variations of 10% W.C.
f. End-to-end accuracy not to exceed 1.0% over entire range.
g. Integral, accessible zero and span adjustment.
h. Over pressure input protection to a minimum of five times rated input.

E. Differential Pressure Switches - Air Service
1. Provide differential pressure air switches as follows:
a. SPDT switch action or two (2) SPST switches rated for 10 amps minimum at 120 Vac.
b. Set point trip adjustment over, at minimum, of operating range. Dead band adjustment down to, at maximum, 10% of operating range.

c. Operating range of 1.0 in. W. C. to 3.0 in. W. C. for fans with a total static pressure rating of 2.5 in. W. C. or less and 2.0 in. W. C. to 6.0 in. W. C. for fans having a total static pressure rating of greater than 2.5 in. W. C. Operating range of 0 to 1.0 in. W. C. for filter status applications.
d. Shock and vibration protection as necessary.
e. Materials and construction suitable for application.
f. Manual reset shall be provided for air differential pressure switches used in high positive and negative pressure output applications. High differential pressure switches shall be provided for all VAV AHU.
g. Air differential pressure switches used in filter status applications shall be equipped with an analog gauge. Gauge shall indicate actual differential pressure and differential pressure set point of switch.

2. High differential pressure switches shall be wired in series with other safety devices to the respective motor starter.

F. Thermostats
1. Provide as applicable, line voltage (120 Vac) or, low voltage wall mounted thermostats for equipment as identified on the Mechanical Drawings. Install thermostats as located on the Mechanical Drawings.
2. Each thermostat shall be for single stage with a variable set point 65º to 85ºF and shall initially be set up to control space temperature as designated in the sequences of operation.
3. Provide a 3°F dead band.
4. The thermostats shall be complete with bases and sub-bases.
5. The thermostats shall be rated for the application, and shall contain sufficient relay contacts to control valves, fans and dampers.
6. Thermostats controlling equipment in hazardous locations shall meet all applicable codes and requirements regarding the respective hazard.

G. Refrigerant Leak Detection
1. Provide a refrigerant leak detection system to monitor the refrigerant levels in the Central Point.
2. The refrigerant leak detector and controller shall meet the following requirements:
a. Accuracy of, at minimum 10% of full scale.
b. Response time of, at maximum, one (1) minute.
c. Recovery time of, at a maximum, three (3) minutes.
d. Alarm adjustable from 10% to 100% of full scale.
e. Local LED’s indicating PPM concentration, power status and alarm status.
f. Ambient operating temperature of sensor and controller shall be 0º to 120ºF.
g. Remote sensors (3 minimum).
h. Output signal of 0-5 Vac.
i. Wall mounted 18 in. above finished floor, lockable NEMA 1 enclosure. Refer to Mechanical Drawings for location.
j. Alarm test and sensor fault functions.
k. Gas calibration kit.
l. Power supply and battery back-up for electrical supply.
m. Gas of interest shall be coordinated with the selected chiller manufacturer.
n. 120 dB local audible alarm.
o. Local high intensity strobe alarm light.

3. The sensing range shall correspond with the gas of interest and shall be one of the following:
    a. CFC (R22) - 0-1000 PPM
    b. HFC and HCFC - 0-300 PPM
    c. R-123, NH, R134a - 0-200 PPM
    d. Oxygen - 0-25%
4. The refrigerant leak detector shall be a Haloguard Type II by Thermal Gas Systems, Inc. or approved equal.

H. Freezestats
1. Provide freezestats with a minimum 20-ft. vapor tension element, which shall serpentine, the inlet face on all air handling unit cooling which receive unconditioned outside air. One or more of these devices shall be provided and wired in series in order to provide one linear foot of coil surface area.
2. The freezestats shall have a manual reset. It shall not be possible for the switch to reset until the duct temperature has increased by at least 10ºF above the set point.
3. Hardwire interlock to the associated fan so that fan will shut down when HOT switch is in Hand or Auto position. Provide time delay relays with minimum two (2) minute time delay duration to minimize nuisance freezestats trips.
4. Cut out temperature shall be adjustable in the range of, at minimum, 32ºF to 40ºF.

I. Current Sensing Relays
1. Provide current sensing relays as follows:
    a. Solid core current transducer.
    b. Switching range suitable for the application.
    c. Self-powered transducer.
    d. Normally open status contacts.
    e. Hysteresis amperage of no less than 0.2 amps.

J. Photocell Light Controller
1. Provide a photocell with built-in time delays and ancillary devices as necessary for the BCS monitoring of exterior (ambient) light levels. The photocell shall be enclosed within a NEMA Type III housing mounted on the roof level and be 120 Vac or 24 Vac and shall provide a contact closure at the required light level. The photocell shall be Tork #5403 or equivalent.

K. Current-To-Pressure Transducer
1. Provide, current-to-pressure transducers as follows:
    a. Internal materials of the transducer suitable for continuous contract with industrial standard instrument air.
    b. Output signal of 3-15 psig proportional to input current.
    c. Input signal of 4-20 mA with a maximum input impedance of 500 ohms.
    d. Standard operating air pressure shall be 20 psig, not to exceed 30 psig.
    e. Air consumption shall not exceed 0.101 scfm at 15-psig supply.
    f. Combined non-linearity, repeatability and hysteresis not to exceed 2.0% of full-scale output over entire range.
    g. Operating temperature range of 32ºF to 100ºF with 5-90% RH (non-condensing).
    h. Dustproof housing.
    i. Shock and vibration protection as necessary.

L. Restrictors
1. Provide on-line restrictors, between damper and valve actuators and transducers, where necessary, to ensure a smooth and orderly operation of actuators as follows:

a. Suitable for ambient temperatures to 120ºF at a minimum.
b. Pressure rating of a minimum of 50 psi.
c. Material of construction suitable for instrument air services.
d. Orifice suitably sized for application. Where doubt exists as to required orifice size install restrictor having an adjustable orifice.

M. Current-To-Pressure Switch
1. Provide current-to-pressure switch as follows:
a. Input switching range of 24-28 Vac or 28 Vde.
b. Three port with two-position operation.
c. Maximum power consumption of 20 watts.
d. Provide all connections necessary between these switches, the BCS and the controlled end devices.
e. Operable ambient temperature range of, at minimum, 20ºF to 120ºF with 5% to 90% RH (non-condensing).
f. Internal materials suitable for continuous contact with commercial standard instrument air.
g. Protective housing.
h. Shock and vibration protection as necessary.

N. Pressure-To-Current Transducers
1. Provide pressure-to-current transducers as follows:
a. Internal materials of the transducer suitable for continuous contact with industrial standard instrument air.
b. Output signal of 4-20 mA proportional to input pressure, into a maximum of 500 ohm load.
c. Output variations of less than 0.2% full scale for supply voltage variations of 10%.
d. Combined non-linearity, repeatability and hysteresis effects not to exceed 0.5% of full-scale output over entire range.
e. Integral, accessible zero and span adjustment.
f. Operating temperature range of 20ºF to 120ºF with 5-90% RH (non-condensing).
g. Temperature effect of 1.5% full scale/120ºF or less.
h. Over pressure input protection to a minimum of twice the maximum working input pressure.
i. Dustproof housing.
j. Shock and vibration protection as necessary.
k. Input range of 0 to 20 psi.
2. Control Air Pressure Reducing Station.
3. Provide control air pressure reducing stations as follows:
a. Inlet pressure rating up to 150 psig.
b. Outlet regulated pressure of 0 to 25 psig by locking setscrew.
c. Safety pressure relief.
d. Coalescent type oil removal filter. Filter shall be replaceable cartridge type capable of removing contaminants of 5-micron diameter or greater.
e. Automatic moisture removal trap with manual override.
f. 0 to 30-psig pressure gauge on outlet side of pressure reducing valve.
g. Isolation valves on each side of pressure reducing station to facilitate removal.

O. Fan Inlet Velocity Sensors/ Duct and Plenum Probes

1. Sensors shall be of the thermal dispersion type with true average, independent multi-point sensing capability. Sensors shall be totally constructed from non-corrosive materials, with 304 stainless steel sensor bodies, 304 stainless steel mounting brackets, adjustable cadmium-plated muting rods and “bead in glass” thermistor sensors. Each fan airflow monitoring system shall incorporate at least two sensor probes with four thermistors each.
2. Fan Inlet Performance Requirements – The individual sensor accuracy for airflow shall be better than ±0.15ºF (±0.1ºC) over the entire operating range.
3. Fan Inlet Sensor Operating Ranges – Airflow: 0 to 10,000 FPM; Temperature: -20ºF to + 160ºF; Relative Humidity: 0 to 99% (non-condensing).
4. Transmitter shall be constructed of an aluminum chassis designed to operate between minus 20ºF and 120ºF. Transmitter shall be equipped with a 12-bit A/D converter with a minimum reading accuracy of 2%. Transmitter shall output a 4-20 mAdc or 0-10 Vdc signal proportional to air velocity.
5. Approved manufactures and equipment shall include only the following:
    a. Ebtron Advantage III Gold Series probes, combination airflow/ temperature sensors with GTx116-F (Duct and Plenum Probe) or GTx108-F (Fan Inlet Sensor) transmitter as appropriate.
    b. No substitutions.

P. CO2 Sensors
1. Sensors shall be wall-mounted, of the non-dispersive infrared type, for measuring environmental CO2 concentration. Sensors shall measure accurately from 0-2000 ppm. Sensor to be equal to Veris Industries model CWE (for wall-mounted CO2 sensor applications) or Veris Industries model CRLSXX (for duct-mounted CO2 sensor applications) as appropriate.

2.09 AUTOMATIC VALVES - GENERAL

A. Furnish all valves shown on the Mechanical Drawings and/or described in the sequences of operation as automatic control valves. The Mechanical Installer shall install valves. All other valves such as check valves, relief valves, pressure reducing valves, self-regulating valves, manually operated valves, etc. shall be furnished and installed by the Mechanical Installer. Provide details of the manufacturer’s installation requirements to the Mechanical Installer. Refer to the mechanical drawings for the design conditions on which to base sizing and ratings of the valves and their actuators.

B. All valves shall be in accordance with ANSI B16.10, and ANSI B16.34 as appropriate and all other applicable standards. At minimum, valves shall meet ANSI Class 150 ratings and valves detailed to have minimum working pressure ratings in excess of 150 psig shall, at minimum, meet ANSI Class 300 ratings. Where there is a conflict between ANSI, and other applicable standards, the most stringent shall apply. All valves shall be tested to a minimum of 1.5 times the maximum working pressure rating.

C. Valves shall have the manufacturer’s name and the pressure rating clearly marked on the outside of the body. Where this is not possible manufacturer’s name and valve pressure rating shall be engraved on a minimum 2-in. diameter stainless steel tag that shall be attached to the valve by a chain in such a manner that it cannot be unintentionally removed.

D. Valves up to 2 in. in size shall have screwed ends. Valves 2.5 in. and larger shall have flanged ends. Flanged valves shall be furnished complete with companion flanges, gaskets and bolting materials. Flanges, gaskets and boiling materials shall meet the requirements of ASME/ANSI B16.3, B16.5, B16.9, B16.11 and all other relevant standards.

E. Valves shall be suitable for continuous throttling. Control valves shall be selected so that cavitation does not occur over the full operating range of the valve at the system differential pressures. The control valve assembly shall be capable of tight shut-off when operating at system pressure with the system pump operating at shut-off head.

F. Valve schedules shall be submitted for review and shall clearly show the following for each valve:
   1. Associated system.
   2. Manufacturer and model number.
   3. Size.
   4. Flow rate, flow coefficient – (CV) and pressure drop at design conditions.
   5. Valve configuration (e.g. two way, three way, butterfly).
   6. Leakage rate.
   7. Maximum pressure shut-off capability.
   8. Actuator manufacturer and model number.
   9. Valve body pressure and temperature rating.
   10. Normally open/closed and failure positions.

2.10 DAMPERS - GENERAL

A. Furnish all automatic dampers (AD), as indicted on the Mechanical Drawings. Fusible link dampers for fire protection (FD), smoke dampers (SD) fire smoke dampers (FSD), and manual dampers (MD) for balancing, back draft dampers (BD) and dampers which are specified as part of a factory built air handling unit or terminal unit are not furnished by the BCS Installer. The Mechanical Installer shall install all dampers. Provide details of the manufacturer's installation requirements to the Mechanical Installer.

B. Provide damper actuators for all dampers that are furnished as part of this Contract. Where practical actuators shall be factory mounted.

C. Dampers incorporating multiple sections shall be controlled in unison. Where more than one actuator serves a damper, then the actuators shall be driven in unison and the control wiring shall be provided accordingly. Damper sections shall not exceed sixteen (16) square ft. in face area. Damper jackshafts are not acceptable for controlling multiple damper sections.

D. Dampers incorporating multiple sections shall be designed in such a way that the actuators, whether externally or internally mounted, are accessible without difficulty. Under no circumstances shall it be necessary to remove damper sections, or structural or other fixtures to facilitate removal of damper motors. Provide access doors where necessary to meet this requirement. In particular ensure that where in-air stream actuators are provided they are readily accessible.

E. For all AD, FSD, and SD that are interlocked to a fan motor(s), the BCS Installer shall wire between the MCC or local starter and the damper actuator. Dampers interlocked to fan motors shall be driven open and spring closed unless otherwise indicated in the Contract Documents. The 120 Vac power supply originating from the MCC or local starter shall be used to power the damper where possible. If the damper is indicated to be spring open and driven closed or requires a separate power source then the BCS Installer shall provide the necessary interposing relays and shall obtain the power supply to hold the damper closed from the nearest available power panel. The BCS Installer shall wire between the AD, FSD or SD position indicator switch, whose contacts shall be rated for a load up to 10 amps at 120 Vac, and the MCC or local starter. The damper position indicator switch contacts shall be closed when the damper is fully open and open when the damper is not fully open. The Fire Alarm System control of interlocked dampers shall be via the fan motor starter.

F. Automatic Dampers

1. Automatic Dampers (AD) shall be factory fabricated.
2. Damper frames shall be constructed of 16-gauge thick welded galvanized steel channel, or 1/8 in. thick extended aluminum channel. Frames in excess of 3 ft. by 3 ft., shall have corner braces or equivalent means of strengthening to ensure squareness and rigidity. Channel dimensions shall be a minimum of 5 in. by 1 in. Frames shall be constructed for flanged ductwork connection. “Slip-In” (insertion) type dampers shall not be acceptable. Frames shall be sized to match the final dimensions of the ducts including allowance where applicable, for the duct lining materials. Coordinate required installation details with Mechanical Installer. The BCS Installer shall be responsible for coordination of correct sizing for damper assemblies furnished as part of this Contract. Blade stops shall not extend more than 1/2 in. into the air stream.
3. Damper blades shall be constructed of:
    a. Galvanized sheet steel of minimum 21-gauge thickness with a minimum of four (4) breaks running the entire length of the blade.
    b. Double galvanized sheet steel of minimum 22-gauge thickness per sheet. Sheets shall be formed with a minimum of four (4) breaks in each sheet running the entire length of the blade. Sheets shall be spot welded together, or
    c. Airfoil shaped double skin-galvanized steel constructed from minimum 14-gauge thick galvanized sheet steel.
    d. Airfoil shaped double skin-extruded aluminum constructed from minimum 16-gauge thick sheet.
4. Maximum width for galvanized steel blades shall not exceed 8 in. and for aluminum shall not exceed 6 in. Maximum blade length shall not exceed 48 in.
5. Blade edge seals shall be field replaceable and shall be one of the following:
    a. Neoprene
    b. Vinyl
    c. Polyurethane
    d. Silicone rubber
    e. Synthetic elastomer
6. Blade end (side) seals shall be one of the following:
    a. Continuous spring stainless steel strip
    b. Synthetic elastomer
    c. Flexible aluminum compression type.
7. Damper sections shall be installed such that the blades are horizontal.
8. Damper axles shall be constructed of:
    a. Minimum 1/2 in. square zinc plated steel with non-slip between blade and axle.
    b. Minimum 1/2 in. hexagon zinc plated steel with non-slip locking between blade and axle.
    c. Minimum 1/2 in. diameter zinc plated steel fastened to the blades with bolts through the axle, rivets or welds to ensure non-slip locking between blade and axle.
9. Damper axle bearings shall be one of the following:
    a. Oil impregnated sintered bronze
    b. Stainless steel sleeve
10. Linkage that interconnects blades shall be corrosion resistant steel and shall be located on the face of the damper in the air stream or shall be concealed in the frame. Linkages shall be readily accessible for maintenance.

11. Control shaft shall be as specified above and shall extend beyond the frame as necessary to match up with actuator or actuator linkage as applicable.
12. Modulating dampers shall be of the opposed blade type. Two position dampers shall be of either the parallel or opposed blade type.
13. Multiple section dampers shall bolt together to form a rigid structure free from twisting or bending.
14. The two diagonal measurements from upper to lower opposite corners of the installed damper assembly, including multiple section dampers, shall not differ by more than 0.15 in. or 0.2 percent, whichever is greater.
15. The free area ratio, i.e. the open area in a damper assembly, including in-air stream actuators, divided by the total duct area shall not be less than 0.75 for velocities above 1500 fps and 0.6 for velocities below 1500 fps. This shall apply to both single and multiple damper section assemblies.
16. Maximum leakage rate through a 48 in. by 48 in. closed automatic damper shall not exceed 10 CFM per square foot of overall damper face area at 4 in. W.C. pressure differential with a maximum closing torque not exceeding that applied by the actuator provided for the damper. The leakage rate of the field-installed damper shall not exceed the rate specified above. Dampers shall be rated for the maximum air stream face velocity that they will experience during normal operation.
17. Damper schedules shall be submitted for review and shall clearly indicate the following for each damper:
    a. Associated system.
    b. Manufacturer and model number.
    c. Mechanical drawing reference.
    d. Damper size for each section.
    e. Parallel or opposed blade configuration.
    f. Actuator manufacturer and model number for each section.
    g. Ratio of anticipated air stream velocity to the manufacturer’s maximum recommended velocity rating.
    h. Free area ratio.
18. If the automatic damper complies with these specifications, one of the following manufacturers will be acceptable:
    a. Greenheck
    b. Pottorff
    c. Ruskin

G. Fire Smoke Damper (FSD)
1. Fire Smoke Dampers (FSD) shall be factory fabricated.
2. Damper frames shall be constructed of minimum 16 gauge welded galvanized steel channel. Frames in excess of 36 in. height shall have corner braces or equivalent means of strengthening to ensure squareness and rigidity. Frames shall be constructed for flanged ductwork connection. “Slip In” (insertion) type dampers shall not be acceptable. Frames shall be sized to match the final dimensions of the ducts including allowance where applicable, for the duct lining materials. Coordinate required installation details with Mechanical Installer. BCS Installer shall be responsible for coordination of correct sizing for damper assemblies furnished as part of this Contract. Blade stops shall not extend more than 1/2 in. into the air stream.
3. Damper blades shall be constructed of:

a. Galvanized sheet steel of minimum 16 gauges with a minimum of three (3) breaks running the entire length of the blade.
b. Airfoil shaped double skin-galvanized steel constructed from minimum 14-gauge sheet.

4. Maximum width for galvanized steel blades shall not exceed six (6) in. Maximum blade length shall not exceed 48 in. for airfoil blades and 36 in. for grooved blade.
5. Blade end (side) seals shall be one of the following:
   a. Silicone rubber.
   b. Flexible metal compression type.
6. Damper sections shall be installed such that blades are horizontal.
7. Damper axles shall be constructed of:
   a. Minimum of 1/2 in. square in. zinc plated steel with non-slip between blade and axle.
   b. Minimum 1/2 in. hexagonal zinc plated steel with non-slip locking between blade and axle.
8. Bearings shall be stainless sleeve type.
9. Linkage that interconnects blades shall be corrosion resistant steel and shall be concealed in the frame. Linkages shall be readily accessible for maintenance.
10. Control shaft shall be as specified above and shall be specified above and shall extend beyond the frame as necessary to match up with actuator or actuator linkage as applicable.
11. Modulating dampers shall be of the opposed type. Two position dampers shall be of either the parallel or opposed blade type.
12. Modulating dampers shall bolt together to form a rigid structure free from twisting or bending per the manufacturer's approved methods.
13. Measurements diagonally from upper to lower opposite corners of the installed damper assembly, including multiple section dampers shall not differ by more than 1/8 in. or 0.2%, whichever is greater.
14. The free ratio, i.e., the open area in a damper assembly divided by the total duct area shall not be less than 0.8. This shall apply to both single and multiple damper section assemblies.
15. Maximum leakage shall be as for UL 555S Class 1 low-leakage type. Maximum leakage rates shall not exceed the Class 1 UL rating. The FSD shall meet UL555, UL555S, NFPA 90A and NFPA 92A requirements in all respects including size limitations. The FSD shall be one and one half (1 ½) hour fire rated and listed under UL standard 555. The damper and damper actuator shall be furnished as an integral unit and shall be equipped with a UL classified and listed fire stat meeting the elevated temperature qualification of UL 555S at 250ºF.
16. Provide damper position indicator switches that shall be an integral part of the damper actuator or shall be linked directly to the damper blades for indication of the fully open and fully closed position when required by the sequence of operation or the FAS. The damper position indicator switches shall be factory mounted and adjusted by the damper manufacturer. When FSD are associated with a fan these damper position indicator switches shall be hardwire interlocked to inhibit motor start-up. The motor start-up shall be inhibited when the HOT switch is in both the "hand" and "auto" positions. Where damage can result to mechanical components (fans, dampers, etc.). If a damper fails to open prior to fan start-up, then the interlock between the fan and damper shall not be overridden by the fire control system. The BCS Installer shall install the hardwire interlocks.
17. Dampers shall be rated by the manufacturer for normal operations, for the maximum face velocity that will be imparted by the air stream in which the damper is installed.

18. Damper schedules shall be submitted for review and shall clearly indicate the following for each damper:
    a. Associated system.
    b. Manufacturer and model number.
    c. Mechanical Drawing reference.
    d. Damper size for each section.
    e. Parallel or opposed blade configuration.
    f. Actuator manufacturer and model number for each section.
    g. Normally open/closed and failure positions.
    h. Damper end switch interlock.
    i. High temperature closing devices.
    j. Ratio of anticipated air stream velocity to the manufacturer's maximum recommended velocity rating.
19. If the FSD complies with these specifications, one of the following manufacturers will be acceptable:
    a. Ruskin
    b. Pottorff
    c. Greenheck

2.11 DAMPER ACTUATOR

A. Damper Actuators.
1. Provide damper actuators for all automatic control dampers, including those furnished as part of a packaged air-handling unit.
2. Electric damper actuators used for two-position service shall be of the spring return type. Modulating dampers shall be motorized in both directions with spring return to the failure (de-energized) position. Unless stated otherwise in these Contract Documents dampers shall fail to the closed position on loss of power. Damper actuators shall have a service life, at minimum, of 60,000 fully closed to fully open to fully closed operations. In addition the modulating damper actuators shall have a service life of, at minimum, 1000 spring operations on loss of power.
3. Actuators shall stroke by the rotating motion of a reversible, overload-protected synchronous motor or shall be direct-coupled rotary type actuators.
4. The actuators shall be protected against overload by an integral magnetic clutch that shall allow the motor to continue running when, for example, the actuator is stalled at the end of its stroke or by a jammed damper. Alternatively, stall protection shall be by non-overloading impedance protected motor.
5. Provide sufficient quantity of additional damper actuators to meet the damper leakage requirements for the installed damper assembly. At minimum the torque provided shall be such as to meet the maximum close-off leakage requirements.
6. Provide mounting brackets suitable for extended shaft mounting or direct damper drive shaft mounting. The actuator housing shall be rugged and non-corrosive.
7. Damper actuator shall be fully accessible for ease of maintenance. Shop drawings shall clearly indicate motor locations on multiple section damper assemblies.
8. The actuators shall stroke two position dampers from fully closed to fully open in less than two (2) minutes. Modulating dampers shall be driven from fully closed to fully open and vice versa in less than two (2) minutes. This time shall not include the initial period following the availability of power, not to exceed 200 seconds, which is required to tension the spring.
9. The control signal to the modulating damper actuators shall be compatible with the BCS analog output subsystem e.g. 4-20 mA, 0 to 10 Vdc, etc.

10. Actuators shall be as manufactured by Belimo.

2.12 SMOKE DETECTORS

A. The contractor shall for each air handling system with 2000 CFM (nominal 5 Tons) or greater airflow, install UL-listed ionized smoke detectors in the main supply air duct and main return air duct and/or where shown on the drawing. Smoke detectors furnished by Division 26. Refer to Section 23 05 12. Connect the detectors into the control circuit to stop the fan in the event of the presence of smoke.
   1. System airflow included the total airflow of all units serving any single space and all units connected to the same return air plenum.

PART 3 - EXECUTION

3.01 GENERAL

A. All grounding, wiring, selection of components and installations shall conform to the National Electrical Code with amendments to the date of issue of this specification.

B. The installation shall conform to each manufacturer's recommended procedures and to all applicable codes, statutes and ordinances and to the Contract Documents. In each and every instance of application, the code, regulation, statute, by-law or specification having the most stringent requirements shall apply.

C. All installations to be performed by skilled and certified technicians.

D. All equipment installed shall be mechanically stable and, as necessary, fixed to wall or floor. Provide anti-vibration mounts, if required, for the proper isolation of the equipment.

E. Install equipment so as to allow for easy maintenance access. Install equipment such that it does not interfere in any way with across to adjacent equipment and personnel traffic in the surrounding space.

F. Install equipment in locations providing adequate ambient conditions for its specified functioning, allowing for adequate ventilation and with no condensate traps.

G. All components placed in areas of high humidity or potentially high humidity must be adequately protected.

H. The Contractor shall for each handling system with 2000 CFM airflow (nominal 5 Tons) or greater, install UL listed ionization smoke detectors in the main return air duct, and/or where shown on the drawings. Smoke detectors may be omitted from the main supply air duct when explicitly not required by local code. Smoke detectors furnished by Division 26. Refer to Section 23 05 12. Connect the detectors into the control circuit to stop the fan in the event of the presence of smoke.
   1. System airflow includes the total airflow of all units serving any single space and all units connected to the same return air plenum.

3.02 CONDUIT, WIRING, CABLING AND FITTINGS

A. The installation shall conform to the Division 23 and 26 Contract Documents for this project.

B. All wires and cables for powering the BCS as provided shall be:
   1. Ninety-eight (98) percent conductivity copper.
   2. A minimum of #12 AWG for branch 120 VAC power circuits.
   3. A minimum of #14 AWG for DO motor control circuits.
   4. A minimum of #18 AWG for sensing, transmitter, DO (except motor control circuits) and AO control circuits. Where manufacturers recommend a heavier conductor, then the BCS Installer shall comply with the manufacturer's recommendation.
   5. A minimum of #20 AWG for communication trunk, shielded and grounded at a single end.
   6. Stranded copper conductors throughout for #18 AWG and smaller diameter wire.
   7. Continuously color coded insulation in accordance with Section 26 05 19 entitled "Wire and Cable".

C. All cabling shall be plenum rated cable and shall be as specified above with the following additional requirements:
    1. All plenum rated wire and cable shall be a minimum of #18 AWG and shall be shielded.
    2. Cable jacket shall have a minimum thickness of 0.015 in. and shall be bright orange, red, yellow or other bright, distinctive color. Coordinate jacket color with other trades.
    3. Plenum wiring and cabling shall be routed through cable rings. Cable rings shall be suitably spaced to properly support plenum cabling and shall be attached to ductwork hangers or structure as applicable.
    4. Plenum cable shall be as manufactured by Belden, Kynar, Dekoron or approved equal.
D. Smaller gauge wiring shall be acceptable if certified by the equipment manufacturer. If complications arise, however, due to wiring size, replace the wire at no additional cost to the Owner.
E. The sizing and provision of conduit and type of wire for the main BCS trunk wiring are the design responsibility of the BCS Installer.
F. Obtain and pay for all electrical inspection fees related to the work of this section.
G. Perform circuit tests using qualified personnel only. Provide necessary instruments and equipment to demonstrate that:
    1. All circuits are continuous and free from short circuits and grounds.
    2. All circuits are free from unspecified grounds; that resistance to ground of all circuits is no less than 50 megohms.
H. Provide complete testing for all wiring installed or utilized as part of this work. Provide all equipment, tools, and personnel as necessary to conduct these tests.
I. Provide complete grounding of all power and signal wiring so as to ensure system integrity of operation.
J. NCP/ASC shall not be mounted in-line with vertical conduit but shall be connected off to the side of the vertical conduit by suitably pitched conduit such that any condensed moisture in the vertical conduit cannot enter the NCP/ASC enclosures.
K. All analog and digital input points and communication cables shall have shielded wiring. Non-shielded wiring may only be provided upon certification from the manufacturer that non-shielded wiring will not cause degradation of system performance and will not render the system more susceptible to damage. However, if complications arise from the use of non-shielded wiring, replace the wiring at no additional cost to the Owner.
L. BCS wiring shall not run in the same conduit as power wiring of any voltage.
M. Suitably coated wire may be used in ceiling spaces and in tenant wall partitions without conduit where local codes permit and the cable jacks and insulation have been accepted under the provisions of the National Electrical Code and have been classified by UL, Inc. For use without conduit in air plenums. Elsewhere use Electrical Metallic Tubing (EMT).
N. Sleeves shall be provided by the BCS Installer where required and shall meet the requirements detailed in the Division 26 Contract Documents for this project.
O. All wiring shall be marked in accordance with the National Electrical Code. Provide the labeling of wire at every termination. Each wire shall be identified which uniquely identifies each wire and which corresponds to the shop Drawings and as-built Drawings provided under this Contract.

3.03 EQUIPMENT, INSTALLATION

A. Locate temperature sensors, humidity sensors, thermostats, and humidistat for room control immediately as shown on the mechanical drawings. Prior to installation, coordinate sensor and/or thermostat locations with the Owner and Architect.
    1. Prior to installation, coordinate sensor and/or thermostat locations with Owner's Representative.

B. Mount local control panels on at convenient locations adjacent to equipment served.
   1. Mount all relays, etc., internal to the temperature control panels.
   2. Tag each instrument corresponding to symbols used on control diagrams.
C. Mounting of controllers on air handling units shall not be allowed.
D. Furnish all control valves (globe and butterfly, as applicable) to the Mechanical Installer. Mechanical Installer to install control valves per the valve manufacturer's recommendations.

3.04 COMMISSIONING

A. BCS shall be installed and commissioned by factory-trained technicians skilled in the setting and adjustment of BCS equipment used in this project. This technician is to be experienced in the type of systems associated with this BCS,
B. Perform a complete and detailed calibration and operational check for each individual point and for each individual function as contained within the BCS. These checks shall ensure that all equipment, software, network elements, modules and circuits as provided under the terms of this contract are functioning as per the Contract Documents. Such checks shall be carried out with the use of point/function log sheets. Point/function sheets are to be prepared by the Contactor and submitted to the Engineer for the approval of content and format. Such calibration and operation checks shall be performed prior to the commencement of final tests on completion for any relevant system part. The point/function logs shall, at minimum, include the following:
   1. Identification of each point by BCS point name and expanded descriptor.
   2. Indication of BCS value/status, field-tested value/status, and deviation between the BCS and field-tested value/status.
   3. Confirmation of system safeties operation.
   4. Confirmation of proper failure modes of motors, dampers, valves, etc.
   5. Confirmation of proper tuning of PID control loops.
   6. Confirmation of proper sequence of operation performance.
   7. Manufacturer, model number and accuracy of test instruments used.
   8. Date of testing/verification and name of individuals performing the tests.
C. At time of final observation, demonstrate the sequence of operation for each system to the Owner and Engineer. Perform system demonstration as directed by Owner and Engineer.

3.05 TRAINING

A. Provide a minimum of 40 hours of instructions to Owner's personnel in the operation and maintenance of the control system. Provide training after the system has been installed and commissioned. Training shall be on-site, using the installed BCS as the basis for training. Provide Training Manuals and O&M Manuals for students attending on-site training.
B. Provide a paid tuition for one student to attend a minimum 5-day factory-training course at the BCS manufacturer's training facility.

3.06 WARRANTY

A. At completion of final test of installation and acceptance by Owner, provide any service incidental to proper performance for a period of one year.
B. Equipment shall be warranted for one year (including defects in workmanship and material) under normal use and service. During warranty period supplier shall also replace or repair, free of charge, any equipment proven to be defective in workmanship or material.
C. Certain electronic devices not manufactured by the BCS supplier such as computers, etc., shall carry the original manufacturer's warranty. Pass any registration and warranty documents and warranty rights to the Owner.
D. All software upgrades, enhancements or revisions that are initiated by the BCS manufacturer up to the time of expiration of the warranty period shall be provided at no additional cost to the Owner.

END OF SECTION

SECTION 23 31 13.19
DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of ductwork accessories work is indicated on drawings and in schedules, and by requirements of this section.

B. Types of ductwork accessories required for project include the following:
   1. Dampers.
      a. Low-pressure manual dampers.
      b. Control dampers.
      c. Counterbalanced relief dampers.
   2. Fire and smoke dampers.
   3. Turning vanes.
   4. Duct hardware.
   5. Duct access doors.
   6. Flexible connections.
   7. Concealed Damper Regulators.

C. Refer to other Division 23 sections for testing, adjusting, and balancing of ductwork accessories; not work of this section.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Codes and Standards:
   1. SMACNA Compliance: Comply with applicable portions of SMACNA “HVAC Duct Construction Standards, Metal and Flexible,” 2005 edition.
   2. Industry Standards: Comply with latest ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
   3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 “Fire Dampers and Ceiling Dampers.”
   4. NFPA Compliance: Comply with applicable provisions of NFPA 90A latest edition “Installation of Air Conditioning and Ventilating Systems”, pertaining to installation of ductwork accessories.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.

B. Shop Drawings: Submit manufacturer’s assembly type Shop Drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components.

C. Maintenance Data: Submit manufacturer’s maintenance data including parts lists for each type of duct accessory. Include this data, product data, and Shop Drawings in maintenance manual; in accordance with requirements of Division 01.

PART 2 - PRODUCTS

2.01 DAMPERS

A. Low Pressure Manual Dampers: Provide dampers of single blade type or multi blade type, constructed in accordance with SMACNA “HVAC Duct Construction Standards.”

B. Control Dampers: Provide dampers with parallel blades for 2-position control, or opposed blades for modulating control. Construct blades of 16-ga steel; provide heavy-duty molded self-lubricating nylon bearings, 1/2 in. diameter steel axles spaced on 9 in. centers. Construct frame of 2 in. x 1/2 in. x 1/8 in. steel channel for face areas 25 sq.ft. and under; 4 in. x 1-1/4 in. x 16-ga channel for face areas over 25 sq.ft. Provide galvanized steel finish with aluminum touch up.

C. Control Dampers: Refer to Division 23 Section “CONTROL SYSTEMS”: for control dampers; not work of this section.

D. Counterbalanced Relief Dampers: Provide dampers with parallel blades, counterbalanced and factory set to relieve at indicated static pressure. Construct blades of 16-ga aluminum, provide 1/2 in. diameter ball bearings, 1/2 in. diameter steel axles spaced on 9 in. centers. Construct frame of 2 in. x 1/2 in. x 1/8 in. steel channel for face areas 25 sq.ft. and under; 4 in. x 1-1/4 in. x 16-ga channel for face areas over 25 sq.ft. Provide galvanized steel finish on frame with aluminum touch-up.

E. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
   1. Air Balance, Inc.
   2. Nailor
   3. American Warming & Ventilating, Inc.
   4. Louvers & Dampers, Inc.
   5. Penn Ventilator Co.
   6. Ruskin Mfg. Co.
   7. Pottorff

F. Fire Damper (FD)
   1. Fabricated Fire Dampers: Provide dampers constructed in accordance with SMACNA “Fire Damper and Heat Stop Guide”.
   2. Damper frames shall be constructed of minimum 16 gauge welded galvanized steel channel. Frames in excess of 36 in. height shall have corner braces or equivalent means of strengthening to ensure squareness and rigidity. Frames shall be constructed for flanged ductwork connection. “Slip In” (insertion) type dampers shall not be acceptable. Frames shall be sized to match the final dimensions of the ducts including allowance where applicable, for the duct lining materials. Coordinate required installation details with Mechanical Installer.
   3. Fire Dampers: Provide Class B or C Fire dampers, of types and sizes indicated. Provide fusible link rated at 160 to 165°F (71 to 74°C) unless otherwise indicated or required for special exhaust systems. Provide damper with positive lock in closed position, and with the following additional features:
      a. Damper Blade Assembly: Multi blade type, completely out of airstream.
      b. Damper Blade Assembly: Curtain type, completely out of the airstream.
      c. Blade Material: Steel, match casing.
      d. Blade Material: Stainless Steel.
   4. Measurements diagonally from upper to lower opposite corners of the installed damper assembly, including multiple section dampers shall not differ by more than 1/8 in. or 0.2%, whichever is the greater.
   5. Manufacturer: Subject to compliance with requirements, provide fire and smoke dampers of one of the following:
      a. Air Balance, Inc.
      b. American Warming & Ventilating, Inc.
      c. Greenheck
      d. Louvers and Dampers, Inc.

e. Nailor
f. National Control Air
g. Penn Ventilator Co.
h. Pottorff

G. Fire Smoke Damper (FSD)
1. Fire Smoke Dampers (FSD) shall be factory fabricated.
2. Damper frames shall be constructed of minimum 16 gauge welded galvanized steel channel. Frames in excess of 36 in. height shall have corner braces or equivalent means of strengthening to ensure squareness and rigidity. Frames shall be constructed for flanged ductwork connection. “Slip In” (insertion) type dampers shall not be acceptable. Frames shall be sized to match the final dimensions of the ducts including allowance where applicable, for the duct lining materials. Coordinate required installation details with Mechanical Installer. BCS Installer shall be responsible for coordination of correct sizing for damper assemblies furnished as part of this Contract. Blade stops shall not extend more than 1/2 in. into the air stream.
3. Damper blades shall be constructed of:
   a. Galvanized sheet steel of minimum 16 gauges with a minimum of three (3) breaks running the entire length of the blade.
   b. Airfoil shaped double skin-galvanized steel constructed from minimum 14-gauge sheet.
4. Maximum width for galvanized steel blades shall not exceed six (6) in. Maximum blade length shall not exceed 48 in. for airfoil blades and 36 in. for grooved blade.
5. Blade end (side) seals shall be one of the following:
   a. Silicone rubber.
   b. Flexible metal compression type.
6. Damper sections shall be installed such that blades are horizontal.
7. Damper axles shall be constructed of:
   a. Minimum of 1/2 in. square inch zinc plated steel with non-slip between blade and axle.
   b. Minimum 1/2 in. hexagonal zinc plated steel with non-slip locking between blade and axle.
8. Bearings shall be stainless sleeve type.
9. Linkage that interconnects blades shall be corrosion resistant steel and shall be concealed in the frame. Linkages shall be readily accessible for maintenance.
10. Control shaft shall be as specified above and shall be specified above and shall extend beyond the frame as necessary to match up with actuator or actuator linkage as applicable.
11. Modulating dampers shall be of the opposed type. Two position dampers shall be of either the parallel or opposed blade type.
12. Modulating dampers shall bolt together to form a rigid structure free from twisting or bending per the manufacturer's approved methods.
13. Measurements diagonally from upper to lower opposite corners of the installed damper assembly, including multiple section dampers shall not differ by more than 1/8 in. or 0.2% whichever is the greater.
14. The free ratio, i.e., the open area in a damper assembly divided by the total duct area shall not be less than 0.8. This shall apply to both single and multiple damper section assemblies.

15. Maximum leakage shall be as for UL 555S Class 2 low-leakage type. Maximum leakage rates shall not exceed the Class 2 UL rating. The FSD shall meet UL 555, UL 555S, NFPA 90A and NFPA 92A requirements in all respects including size limitations. The FSD shall be one and one half (1 1/2) hour fire rated and listed under UL standard 555. The damper and damper actuator shall be furnished as an integral unit and shall be equipped with a UL classified and listed fire stat meeting the elevated temperature qualification of UL 555S at 250°F.
16. Provide damper position indicator switches that shall be an integral part of the damper actuator or shall be linked directly to the damper blades for indication of the fully open and fully closed position when required by the sequence of operation or the FAS. The damper position indicator switches shall be factory mounted and adjusted by the damper manufacturer. When FSD are associated with a fan these damper position indicator switches shall be hardwire interlocked to inhibit motor start-up. The motor start-up shall be inhibited when the HOA switch is in both the “hand” and “auto” positions. Where damage can result to mechanical components (fans, dampers, etc.) If a damper fails to open prior to fan start-up, then the interlock between the fan and damper shall not be overridden by the fire control system. The BCS Installer shall install the hardwire interlocks.
17. Dampers shall be rated by the manufacturer for normal operations, for the maximum face velocity that will be imparted by the air stream in which the damper is installed.
18. Damper schedules shall be submitted for review and shall clearly indicate the following for each damper:
    a. Associated system.
    b. Manufacturer and model number.
    c. Mechanical Drawing reference.
    d. Damper size for each section.
    e. Parallel or opposed blade configuration.
    f. Actuator manufacturer and model number for each section.
    g. Normally open/closed and failure positions.
    h. Damper end switch interlock.
    i. High temperature closing devices.
    j. Ratio of anticipated air stream velocity to the manufacturer’s maximum recommended velocity rating.
19. If the FSD complies with these specifications, one of the following manufacturers will be acceptable:
    a. Ruskin
    b. Prefco
    c. Greenheck
    d. Pottorff

2.02 SMOKE DAMPERS

A. Smoke Dampers (SD)
    1. Smoke dampers (SD) shall be factory-fabricated.

2. Damper frames shall be constructed of minimum 16 gauge welded galvanized steel channel. Frames in excess of 36 in. height shall have corner braces or equivalent means of strengthening to ensure squareness and rigidity. Frames shall be constructed for flanged ductwork connection. “Slip In” (insertion) type dampers shall not be acceptable. Frames shall be sized to match the final dimensions of the ducts including allowance where applicable, for the duct lining materials. Coordinate required installation details with Mechanical Installer. BCS Installer shall be responsible for coordination of correct sizing for damper assemblies furnished as part of this Contract. Blade stops shall not extend more than 1/2 in. into the air stream.
3. Damper blades shall be constructed of:
    a. Galvanized sheet steel of minimum 16 gauge with a minimum of three (3) breaks running the entire length of the blade.
    b. Airfoil shaped double skin-galvanized steel constructed from minimum 14-gauge sheet.
4. Maximum width for galvanized steel blades shall not exceed six (6) in. for grooved blade.
5. Blade end (side) seals shall be one of the following:
    a. Silicone rubber.
    b. Flexible metal compression type.
6. Damper sections shall be installed such that blades are horizontal.
7. Damper axles shall be constructed of:
    a. Minimum of 1/2 in. square inch zinc plated steel with non-slip between blade and axle.
    b. Minimum 1/2 in. hexagonal zinc plated steel with non-slip locking between blade and axle.
8. Bearings shall be stainless sleeve or oil impregnated sintered bronze type.
9. Linkage that interconnects blades shall be corrosion resistant steel and shall be concealed in the frame. Linkages shall be readily accessible for maintenance.
10. Control shaft shall be as specified above and shall extend beyond the frame as necessary to match up with actuator or actuator linkage as applicable.
11. Modulating dampers shall be of the opposed blade type. Two position dampers shall be of either the parallel or opposed blade type.
12. Multiple section dampers shall bolt together to form a rigid structure free from twisting or bending per the manufacturer’s approved methods.
13. Measurements diagonally from upper to lower opposite corners of the installed damper assembly, including multiple section dampers shall not differ by more than 1/8 in. or 0.2% whichever is the greater.
14. The free-area ratio, i.e., the open area in a damper assembly divided by the total duct area shall not be less than 0.8. This shall apply to both single and multiple damper section assemblies.
15. Maximum leakage shall be as for UL 555S Class 1 low leakage type. Maximum leakage rates shall not exceed 8 CFM per sq. Ft. of overall damper face area at 4.0-in. wg. differential pressure. The leakage rate of the field-installed damper shall not exceed the Class 1 UL rating. The SD shall meet UL 555S, NFPA 90A and NFPA 92A requirements in all respects including size limitations.

16. Provide damper position indicator switches that shall be an integral part of the damper actuator or shall be linked directly to the damper blades for indication of the fully open and full closed position when required by the sequence of operation or the FAS. The damper position indicator switches shall be factory mounted and adjusted by the damper manufacturer. When SD is associated with a fan these damper position indicator switches shall be hardwire interlocked to inhibit motor start-up. The motor start-up shall be inhibited when the HOT switch is in both the “hand” and “auto” positions. Where damage can result to mechanical components (fans, dampers, etc.) If a damper fails to open prior to fan start-up, then the interlock between the fan and damper shall not be overridden by the fire control system. The BCS Installer shall install the hardwire interlocks.
17. Dampers shall be rated by the manufacturer for normal operations, for the maximum face velocity that will be imparted by the air stream in which the damper is installed.
18. Damper schedules shall be submitted for review and shall clearly indicate the following for each damper:
    a. Associated system.
    b. Manufacturer and model number.
    c. Mechanical drawing reference.
    d. Damper size for each section.
    e. Parallel or opposed blade configuration.
    f. Actuator manufacturer and model number for each section.
    g. Normally open/closed and failure positions.
    h. Damper end switch interlocks.
    i. Ratio of anticipated air stream velocity to the manufacturer’s maximum recommended velocity rating.
19. If the SD complies with these specifications, one of the following manufacturers will be acceptable:
    a. Greenheck
    b. Prefco
    c. Ruskin
    d. Pottorff

2.03 TURNING VANES

A. Fabricated Turning Vanes: Provide fabricated turning vanes and vane runners, constructed in accordance with SMACNA “HVAC Duct Construction Standards”.

B. Turning Vanes: Turning vanes shall be double wall turning vanes fabricated from the same material as the duct. Tab spacing shall be SMACNA standard. Rail systems with non-standard tab spacings shall not be accepted. All tabs shall be used, do not skip tabs. Mounting rails shall have friction insert tabs that align the vanes automatically. Vanes shall be subjected to tensile loading and be capable of supporting 250 lbs when fastened per the manufacturer’s instructions.

C. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of air-foil shaped aluminum extrusions with perforated faces and fiberglass fill.

D. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:
    1. Aero Dyne Co.
    2. Anemostat Products Div.; Dynamics Corp. Of America
    3. Barber-Colman Co.
    4. Ductmate Industries, Inc.
    5. Duro Dyne Corp.

6. Hart & Cooley Mfg. Co.
7. Register & Grille Mfg. Co., Inc.

2.04 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
   1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
   2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12 in. Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:
   1. Ventfabrics, Inc.
   2. Young Regulator Co.

2.05 DUCT ACCESS DOORS

A. General: Provide where indicated, duct access doors of size indicated.

B. Construction: Construct of same or greater gauge as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, other side with one handle-type latch for doors 12 in. high and smaller, 2 handle-type latches for larger doors.

C. As an option, clamping type access doors may be installed.

D. Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:
   1. Air Balance Inc.
   2. Ductmate Industries, Inc.
   3. Duro Dyne Corp.
   4. Register & Grille Mfg. Co., Inc.
   5. Ruskin Mfg. Co.
   6. Ventfabrics, Inc.
   7. Zurn Industries, Inc; Air Systems Div.

2.06 FLEXIBLE CONNECTIONS

A. General: Provide flexible duct connections wherever ductwork connects to vibrating equipment. Construct flexible connections of neoprene coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

B. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:
   1. American/Elgen Co,; Energy Div.
   2. Ductmate Industries
   3. Duro Dyne Corp.
   4. Flexaust (The) Co.
   5. Ventfabrics, Inc.

2.07 CONCEALED DAMPER REGULATORS: FOR VOLUME DAMPERS LOCATED ABOVE GYP BOARD, PLASTER OR OTHER HARD CEILINGS:

A. Concealed damper regulators shall be designed to control volume dampers from the ceiling line. Regulators shall be imbedded so the entire unit is flush with the finished surface. The regulator cover plate shall cover the joint between the box and the ceiling. The cover shall be adjustable from 1/2 in. to 1-1/8 in. utilizing the manufacturer's spanner wrench. Coverplate to have zinc plated finish, suitable for painting. Concealed damper regulators to be Young Regulator Model 315.

B. Volume dampers for concealed damper regulators shall be Young Regulator Model 5020-B (round) or Model 820A-C (rectangular), designed and installed for operation by ceiling mounted regulators.

C. Where required, provide Young Regulator Model 927 Right Angle Miter Gears, or Model 1200 Right Angle Worm Gear Regulator, to allow control of a damper that has the damper shaft perpendicular to the shaft from the ceiling mounted damper regulator.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF DUCTWORK ACCESSORIES

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Install turning vanes in square or rectangular 90° elbows in supply, return and exhaust air systems, and elsewhere as indicated.

C. Install manual balancing dampers for branch ducts and individual runout ducts as close to the main duct as possible.

D. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

E. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.03 FIELD QUALITY CONTROL

A. Operate installed ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.

3.04 ADJUSTING AND CLEANING

A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.

1. Label access doors in accordance with Division 23 Section "MECHANICAL IDENTIFICATION".
2. Final positioning of manual dampers is specified in Division 23 Section "MECHANICAL TESTING, ADJUSTING AND BALANCING".

B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.05 EXTRA STOCK

A. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range; obtain receipt.

END OF SECTION

SECTION 23 31 13
METAL DUCTWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

B. All duct dimensions shown on drawings are net inside clear dimensions.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

C. Codes and Standards:

1. SMACNA Standards: Comply with SMACNA's "HVAC Duct Construction Standards, Metal and Flexible", First Edition, 2005, for fabrication and installation of metal ductwork.
2. ASHRAE Standards: Comply with ASHRAE Handbook latest edition, HVAC Systems and Equipment volume, Chapter 16 "Duct Construction", for fabrication and installation of metal ductwork.
3. NFPA Compliance: Comply with latest editions of NFPA 90A "Installation of Air Conditioning and Ventilating Systems" and NFPA 90B" Installation of Warm Air Heating and Air Conditioning Systems".

D. Field Reference Manual: Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

E. Flame/Smoke Ratings: Provide composite mechanical system (insulating material, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

F. All adhesives, sealants and sealant primers shall contain low VOC (Volatile Organic Compunds), as outlined in the South Coast Air Quality Management District (SCAQMD) Rule #1168. The design intent for this project is to obtain LEED Credit 4.1, which requires that all adhesives, sealants and sealant primers comply with the SCAQMD Rule #1168.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.

B. Shop Drawings: Submit scaled layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials and rigidity are not reduced.

C. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 01.

D. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 01.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect shop fabricated and factory fabricated ductwork, accessories and purchased products from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials that are free from visual imperfections including pitting, seam marks, roller marks, and stains and discolorations, and other imperfections, including those that would impair painting.

B. Sheet Metal: All interior ducts shall be constructed with G-60 or better galvanized steel (ASTM A 653/A 653M) LFQ, chem treat. Exterior ductwork or duct exposed to high humidity conditions (i.e. moisture laden exhausts not specified to be stainless steel) shall be G-90 or better galvanized steel LFQ, chem treat.

C. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A167; Type 302, 304, or 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.

D. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B209, Alloy 3003, Temper H14.

E. Copper Sheet: Where indicated, provide copper sheet complying with ASTM B370; H00 temper, except where 060 temper is required for unusual forming.

2.02 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15° change of direction per section. Unless specifically detailed otherwise, use 45° laterals and 45° elbows for branch takeoff connections. Where 90° branches are indicated, provide conical type tees.

C. Duct Liner:

1. Fibrous glass, complying with Thermal Insulation Manufacturer's Association (TIMA) AHC-101; of thickness indicated with a minimum installed R-Value equal to 6.0 (1-1/2 in. thick minimum), with black-coated, fire-resistant airstream face, with EPA-registered antimicrobial agent.
2. Flexible Unicellular
    a. Ductwork Liner: ASTM C534 Type 1, Thickness 1-1/2 : with a minimum R-value equal to R-6.0.
3. Manufacturers:
    a. Certainteed "Toughgard".
    b. Knauf Type "EM".
    c. Johns Mansville "Permacote Linacoustic".
    d. Owens-Corning "Aeroflex Plus".
    e. No Substitutions

D. Duct Liner Adhesive:

1. Comply with ASTM C 916 “Specifications for Adhesives for Duct Thermal Insulation.” Application shall conform to Manufacturer’s written recommendations for the apparent application.
2. Adhesives shall be non-inflammable after curing.
3. Manufacturers:
    a. Benjamin-Foster.
    b. Duro Dyne “FPG”.
    c. Kinco 15-137.
    d. Miracle PF-91.
    e. Manufacturer of duct liner used for this project.

E. Duct Liner Fasteners:
1. Comply with SMACNA “Installation Standards for Rectangular Ducts using Flexible Liner”, Articles S2.0 through S2.11.
2. Comply with lining details as shown in the referenced SMACNA Section, Figures 2-22 and 2-23.
3. Clinched-pin type fasteners shall be “Grip-Nail”, or approved equal.
4. Projecting pins in Type 3 or Type 4 applications shall be clipped off close enough to the retaining disc to provide proper anchoring and to prevent injury to personnel.

F. Duct Sealant:
1. Duct sealer shall be flexible, water-based, adhesive sealant designed for use in all pressure duct systems. After curing, it shall be resistant to ultraviolet light and shall seal out water, air, and moisture. Sealer shall be UL listed and conform to ASTM E 84.
2. Comply with requirements of SMACNA Table 1-2.
3. Manufacturers:
    a. Benjamin-Foster
    b. Ductmate - PROseal.
    c. Duro Dyne S2.
    d. Hardcast.
    e. United Sheet Metal.

G. Duct Cement:
1. Non-hardening, non-migrating mastic or liquid elastic sealant of type applicable for fabrication/installation detail as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
2. Comply with requirements of SMACNA Table 1-2.
3. Manufacturers:
    a. Benjamin-Foster.
    b. Duro Dyne S2.
    c. Hardcast.
    d. United Sheet Metal.

H. Ductwork Support Materials:
1. General:
    a. Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
    b. Comply with applicable provisions of SMACNA 2005 Standards, Figures 4-1 through 4-8, and Tables 4-1 through 4-3.
2. Except where space is indicated as “High Humidity” area, interior support materials of not less than 1/4 in. diameter or 3/16 in. thickness may be plain (not galvanized).

3. For exposed stainless steel ductwork, provide matching stainless steel support materials. For copper ductwork, provide copper, bronze or brass support materials.
4. For aluminum ductwork, provide aluminum support materials except where materials are electrolytically separated from ductwork.

2.03 FLEXIBLE DUCTS

A. General:
1. Spiral wound spring steel with flameproof metallized polyester sheathing, complying with UL181.
2. Comply with applicable provisions of SMACNA 2005 Standards, pages 3-13 through 3-20.
3. Installation shall conform to conditions under which UL listing was granted.
4. Flexible Ductwork runouts shall be limited to 6' - 0" extended length.

B. Insulation:
1. Insulate all flexible ducts, both supply and return, with a minimum R-Value of 6.0, per International Energy Conservation Code – latest edition. Duct shall have a continuous flexible fiberglass sheath with UL approved metallized polyester barrier jacket.

C. Flexible Ductwork shall be equal to ATCO #036

D. Manufacturers: Subject to compliance with requirements, provide flexible ducts manufactured by one of the following:
1. ATCO.
2. Thermaflex.
3. Quietflex.

2.04 FABRICATION

A. Shop-fabricate ductwork in 4,8,10, or 12 ft. lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match mark sections for reassembly and coordinated installation.

B. All duct dimensions shown on drawings are net inside clear dimensions.

C. Shop-fabricate ductwork of gauges and reinforcement complying with SMACNA 2005 Standards as follows:
1. Rectangular, Steel:
a. Tables 1-1 through 1-13.
b. Figures 1-2 through 1-18.
c. Fittings and Construction, Section II.
2. Rectangular, aluminum: Pages 1-31 through 1-33.
3. Round, Oval and Flexible Duct: Section III.

D. Shop fabricate ductwork of gauges and reinforcement complying with ASHRAE Handbook, HVAC Systems and Equipment Volume, Chapter 16 “Duct Construction”.

E. Longitudinal Seams: Pittsburgh lock shall be used on all longitudinal seams. All longitudinal seams will be sealed with mastic sealant. Snaplock is not acceptable.

F. Ductmate or W.D.C.I. proprietary duct connection systems will be acceptable. Duct constructed using these systems will refer to the manufacturers guidelines for sheet gauge, intermediate reinforcement size and spacing, and joint reinforcements.

G. Formed on flanges (T.D.C./T.D.F./T-25A/T-25B) will only be acceptable when submitted for approval prior to installation of any ductwork. Formed on flanges will be constructed as SMACNA T-25 flanges, whose limits are defined on Page 1.36 of the 2005 SMACNA Manual, First Edition. No other construction pertaining to form on flanges will be acceptable. Formed on flanges shall be acceptable for use on ductwork 42 in. wide or less, with 2 in. positive pressure static or less, and must include the use of corners, bolts and cleat.

H. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30° for contracting tapers and 20° for expanding tapers.

I. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division 23 Section “Ductwork Accessories” for accessory requirements.

J. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners. Comply with previous paragraph 2.2.

K. Round Duct Joints:
   1. 0 in. - 20 in. diameter, interior slip coupling beaded at center, fastened to duct with sealing compound applied continuously around joint before assembling and after fastening. Wrap joints with 3 in. wide duct tape.
   2. 21 in. - 72 in. diameter, use 3 piece, gasketed, flanged joints consisting of 2 internal flanges (with integral mastic sealant) split to accommodate minor differences in duct diameter, and one external closure band designed to compress gasketing between internal flanges. Example: Ductmate Spiralmate or equal.
   3. 73 in. diameter and up, use companion angle flanged joints only as defined on page 3-6 of the SMACNA Manual. Refer to manual for proper sizing and construction details. Ductwall to be welded longitudinal seams.

L. Pressure Classifications:
   1. Static pressure ratings for ductwork systems shall be as noted on the drawings, and/or shall conform to requirements of 2005 SMACNA Standards, Table 1-1.
   2. In no case shall the pressure rating of the duct be less than that indicated in Table 1-1 for the apparent duct velocity.
   3. Gauges of metal and reinforcing methods shall conform to SMACNA requirements as follows:
      a. Rectangular Steel: Table 1-3 through 1-13.
      b. Rectangular Aluminum: Tables 1-14 through 1-16.
      c. Round, or Flat Oval, Steel: Table 3-2.
      d. Round Aluminum: Table 3-3.

2.05 FACTORY-FABRICATED DUCTWORK

A. At Contractor’s option, factory-fabricated ductwork sections, fittings, etc., may be substituted for shop-made items.

B. Factory-fabricated items shall comply in every respect with SMACNA requirements listed previously in this Section, or show proof from a recognized, approved independent laboratory, prior to bidding, that the proposed construction methods produce products that equal, or exceed, the SMACNA 2005 Standards.

C. Comply with applicable provisions of International Mechanical Code and local ammendments.

D. Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork and/or fittings of one of the following:

1. Ductmate, Inc., Monongahela, PA.
2. Semco Mfg., Inc.
3. United Sheet Metal Div., United McGill, Inc.

2.06 KITCHEN EXHAUST DUCTS

A. Kitchen Hood: Fabricate kitchen exhaust ducts and supports, used for smoke and vapor removal from cooking equipment, of 16 ga minimum carbon steel with black iron coating with continuous liquid tight external welds at all seams and joints where concealed, and of 18 ga minimum stainless steel where exposed. Kitchen exhaust ducts shll not be galvanized. For duct construction, comply with SMACNA “HVAC Duct Construction Standards”, and NFPA 96 “Removal of Smoke and Grease Laden Vapors from Commercial Cooking Equipment”.
   1. Provide duct access doors at all changes in direction and at 20 ft. o.c. (or more often if required by code) in all grease exhaust ducts.

B. Dishwasher: Ducts for dishwashers shall be 18 gauge stainless steel made liquid tight with continuous external weld for all seams and joints. Provide neoprene gaskets at flanged connections.

PART 3 - EXECUTION

3.01 INSPECTION

A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF METAL DUCTWORK

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage for systems rated 3 in. and under; 1% for systems rated over 3 in.) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8 in. misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type that will hold ducts true to shape and to prevent buckling. Support vertical ducts at every floor. Seal all longitudinal and transverse duct joints and seams with non-hardening duct mastic.

B. All round duct taps shall be conical type. All rectangular duct taps shall have 45° mitered entry per SMACNA.

C. Inserts: Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work.

D. Field Fabrication: Complete fabrication of work at project as necessary to match shop fabricated work and accommodates installation requirements.

E. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Where possible, locate insulated ductwork for 1 in. clearance outside of insulation. Limit clearance to 1/2 in. where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with structural members, suspended ceiling, lighting layouts, sprinkler piping, plumbing systems and similar finished work.

F. Electrical Equipment Spaces: Do not route ductwork through Electric Rooms, transformer vaults, and other electrical equipment spaces and enclosures.

G. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1-1/2 in. Fasten to duct and substrate.

1. Where ducts pass through fire rated floors, walls, or partitions, provide fire stopping between duct and substrate, in accordance with requirements of Division 07 Section “FIRE STOPPING”.

H. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.

I. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

3.03 INSTALLATION OF DUCT LINER

A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards, pages 2-25 thru 2-29.

B. All supply and return ductwork serving air handlers shall be lined with 1-1/2 in. thick acoustical lining for 20 feet from the unit.

3.04 INSTALLATION OF FLEXIBLE DUCTS

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 6 ft. 0 in. extended length.

B. Installation: Install in accordance with Section III of SMACNA’s, HVAC Duct Construction Standards, Metal and Flexible”.

3.05 INSTALLATION OF KITCHEN EXHAUST DUCTS

A. Kitchen Hood: Fabricate joints and seams with continuous welds for watertight construction. Provide for thermal expansion of ductwork through 2000°F (1093°C) temperature range. Install without dips or traps that may collect residues, except where traps have continuous or automatic residue removal. Provide duct access doors at all changes, located on sides of duct 1-1/2 in. minimum from bottom, in direction and at 20 ft. o.c.)or more often if required by code) in all grease exhaust ducts. Access doors shall be fitted with grease tight covers of same material as duct.

B. Dishwasher: Slope dishwasher exhaust ducts back towards dishwasher to drain completely. Where ducts for dishwashers are not self-draining back to the equipment, provide low point drain pocket with copper drainpipe to sanitary sewer. Provide access door in side of duct at drain pockets.

3.06 FIELD QUALITY CONTROL

A. Leakage Tests: After installation of each duct system that is constructed for duct classes over 3 in. is completed, test for duct leakage. Repair leaks and repeat tests until total leakage is less than 1% of system design airflow.

B. The testing shall be performed as follows:

1. Perform testing in accordance with HVAC Air Duct Leakage Test Manual.
2. Use a certified orifice tube for measuring the leakage.
3. Define section of system to be tested and blank off.
4. Determine the percentage of the system being tested.
5. Using that percentage, determine the allowable leakage (CFM) for that section being tested.
6. Pressurize to operating pressure and repair any significant or audible leaks.
7. Re-pressurize and measure leakage.

8. Repeat steps 6 and 7 until the leakage measured is less than the allowable defined in step 5.

3.07 EQUIPMENT CONNECTIONS

A. General: Connect metal ductwork to equipment as indicated; provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.08 ADJUSTING AND CLEANING

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances that might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering that will prevent entrance of dust and debris until time connections are to be completed.

D. Balancing: Refer to Division 23 Section “TESTING, ADJUSTING AND BALANCING” for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION

SECTION 23 37 13
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of air outlets and inlets work is indicated by Drawings and schedules, and by requirements of this section.

B. Types of air outlets and inlets required for project include the following:
   1. Ceiling return air grilles.
   2. Ceiling air diffusers.
   3. Wall registers and grilles.
   4. Linear slot diffusers
   5. Louvers.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:
   1. ARI Compliance: Test and rate air outlets and inlets in accordance with ARI 650 "Standard for Air Outlets and Inlets".
   2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets", latest edition.
   3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
   4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
   5. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
   6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
   7. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Installation of Air Conditioning and Ventilating Systems" latest edition.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
   1. Schedule of air outlets and inlets indicating drawing designation, room location, number furnished, model number, size, and accessories furnished.
   2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
   3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air outlets and inlets wrapped in factory-fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.01 CEILING AIR DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of aluminum, except aluminum only for shower areas and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction Drawings and specifications for types of ceiling systems that will contain each type of ceiling air diffuser. All air devices installed in plaster, gyp board or other hard ceilings or walls shall be provided with a separate mounting frame.

D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on the air device schedule.

E. Diffuser Finishes:
   1. Finish shall be off-white baked enamel.
   2. Color selection shall be from manufacturer's standard color chips, unless otherwise noted.

F. Manufacturer: Subject to compliance with requirements, provide diffusers of one of the following:
   1. Metalaire,
   2. Krueger,
   3. Nailor,
   4. Price,
   5. Titus,
   6. No Substitutions.

2.02 WALL REGISTERS AND GRILLES

A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction Drawings and specifications for types of wall construction that will contain each type of wall register and grille.

D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on the air device schedule.

E. Register and Grille Finishes:
   1. Finish shall be off-white baked enamel.
   2. Color selection shall be from manufacturer's standard color chips, unless otherwise noted.

F. Manufacturer: Subject to compliance with requirements, provide registers and grilles of one of the following:

1. Metalaire,
2. Krueger,
3. Nailor,
4. Price,
5. Titus,
6. No Substitutions.

2.03 CEILING GRILLE

A. General: Except as otherwise indicated, provide manufacturer's standard grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide grilles that have, as minimum, noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide grilles with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling construction with accurate fit and adequate support. Refer to general construction Drawings and specifications for types of ceiling construction that will contain each type of ceiling grille.

D. Types: Provide ceiling grilles of type and with accessories as listed on the air device schedule.

E. Grille Finishes:
1. Finish shall be off-white baked enamel.
2. Color selection shall be from manufacturer's standard color chips, unless otherwise noted.

F. Manufacturer: Subject to compliance with requirements, provide grilles of one of the following:
1. Metalaire,
2. Krueger,
3. Nailor,
4. Price,
5. Titus,
6. No Substitutions.

2.04 LINEAR SLOT DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer’s standard diffusers where shown; of size, shape, capacity and type indicated; constructed materials and components as indicated, and as required for complete installation. Slot diffusers shall be constructed of aluminum with bi-directional, adjustable control vanes that shall be capable of deflecting the air pattern from horizontal along the ceiling, to straight down, or at an intermediate setting. Unit shall be so designed that when deflecting vanes are in the closed position, the air pressure tends to form a tight seal. Airflow rate can be varied without changing the air pattern. The set of vanes in the diffuser that controls the air pattern and flow rate shall perform these functions satisfactorily without the use of an additional damper. Each length of diffuser shall be capable of being installed without any visible means of fastening. Each length of diffuser shall have a self-aligning device permitting long lengths to be aligned without the aligning device visibly apparent.

B. Performance; Provide diffusers that have, as minimum, noise criteria ratings, pressure drop, and throw for each size device as listed in manufacturer’s current data.

C. Ceiling Compatibility; provide diffusers with borders styles that are compatible with adjacent ceiling systems or for suspended mounting, and that are specifically manufactured to fit into ceiling construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling construction that will contain each type of slot diffuser.

D. Types: Provide slot diffusers of type and with accessories as listed on grille schedule.
1. Grille Finishes:

a. Finish shall be white baked enamel, or primer as scheduled.

2. Boot Plenums:
   a. Provide all slot diffusers with lined boot plenums with neck size equal to that shown in drawings on the run outs.

E. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diffusers which may be incorporated in the work include; but are not limited to, the following:
   1. Metalaire,
   2. Krueger,
   3. Nailor,
   4. Price,
   5. Titus,
   6. No Substitutions.

2.05 LOUVERS

A. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide louvers that have minimum free area, and maximum pressure drop for each type as listed in manufacturer's current data, complying with louver schedule.

C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction Drawings and specifications for types of substrate that will contain each type of louver.

D. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.

E. Louver Screens: On inside face of exterior louvers, provide 1/2 in. square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.

F. Manufacturer: Subject to compliance with requirements, provide louvers of one of the following:
   1. Ruskin Co.,
   2. GreenHeck,
   3. Nailor,
   4. Metalaire,
   5. Pottorff,
   6. Krueger.

2.06 OPPOSED BLADE DAMPER

A. Provide opposed blade dampers for all air devices unless where otherwise indicated on the plans.

B. Square damper frames shall be heavy duty extruded aluminum and interlocked to prevent corner separation. The blades shall be heavy gauge extruded aluminum, webbed to prevent bowing in large sizes and tapered to ensure tight closure. Blades shall be assembled on 1 in. centers and pivot on nylon bushings to ensure jam-free operation. Square neck opposed blade dampers shall be Metalaire Model D7 or approved equal.

C. Radial opposed blade dampers shall provide full radial volume control and manufactured of corrosion resistant aluminum material. Radial dampers shall provide durable, jam-free operation for the life of the air handling system. Radial dampers shall have overlapping blade design that insures positive shut-off when required. Radial damper operator shall be accessible through an opening located in the diffuser center cone. Radial opposed blade damper shall be Metalaire Model D3 or approved equal.

D. Radial slide dampers are not acceptable.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

3.03 SPARE PARTS

A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

END OF SECTION

SECTION 26 05 10
GENERAL REQUIREMENTS FOR ELECTRICAL WORK

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all labor, materials, supervision, tools, services, equipment and incidentals necessary for complete and operational systems as specified under this division and as shown on the Contract Drawings.

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

1.02 DRAWINGS AND SPECIFICATIONS

A. Prior to submitting a bid:
   1. Examine the Drawings.
   2. Read the Specifications and other Contract Documents, including Addenda and referenced material.
   3. Visit the site of the work.
   4. Become informed prior to bidding as to existing conditions and limitations of the project.

B. Bring exceptions and inconsistencies in Drawings, specifications, addenda, referenced material, other Contract Documents and site conditions to the attention of the Architect in writing seven days before the bid opening; otherwise be responsible for changes and additions that become necessary during construction.

C. Interpretation or correction of the Contract Documents will be made by Addendum and will be mailed or delivered to each Contract Bidder of Record.

D. Location of material, equipment, devices and appliances shown in the Contract Drawings are approximate and are subject to such revisions as may be necessary or desirable at the time the work is installed. Install the work in relation to existing conditions and be responsible for the correctness of the work with reference to finish elevations and surrounding conditions.

E. The Contract Documents show the general arrangements of the work. Should project conditions require any rearrangement, or if equipment or accessories can be installed to better advantage in a different manner, the Contractor may, before proceeding with the work, prepare and submit five copies of shop drawings of the proposed rearrangement for the Architect's review.

F. If the Contractor proposes to install equipment requiring space conditions other than those shown, he shall assume responsibility for the rearrangement of the space and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accompanied by shop drawings of the space affected.

G. The accompanying Drawings do not indicate the existing electrical installations other than to identify modifications and extensions thereto. Visit the site and ascertain the conditions to be met and the work to be accomplished in removing and modifying the existing work, and installing the new work. Failure to comply with this shall not constitute grounds for any additional payment in connection with removing or modifying any part of the existing installations and/or installing any new or temporary work under this Division.

1.03 CODES AND STANDARDS

A. Execute the work in accordance with local, state and national codes, ordinances and regulations having jurisdiction or authority over the work. Make any and all adjustments required by these agencies without further cost to the Owner. In addition, conform to the applicable provisions and recommendations of the following standards:
   1. National Electrical Manufacturer Association (NEMA)
   2. American Society for Testing and Materials (ASTM)
   3. National Fire Protection Association (NFPA)

4. National Electrical Safety Code (NESC)
5. Institute of Electrical and Electronic Engineers (IEEE)
6. National Electrical Code (NEC)
7. Underwriters' Laboratories (UL)
8. American National Standards Institute (ANSI)
9. International Building Code (IBC)
10. Occupational Safety and Health Administration (OSHA)
11. Americans with Disabilities Act (ADA)
12. Applicable utility companies
13. Texas Accessibility Standards (TAS)
14. International Energy Conservation Code (IECC)

B. Execute the work in accordance with the most current codes and standards in effect at the time of bidding.

C. In the event standards and codes conflict with each other, the most stringent shall apply.

D. Conform to National Electrical Code rules. Provide material and equipment, which is approved by Underwriter's Laboratories, bears UL label and is acceptable to Factory Mutual.

E. It is specifically understood, however, that in those instances where capacities, sizes, etc., of electrical equipment, devices or material as designated in these Specifications or on the Drawings are in excess of the minimum requirements of the National Electrical Code, such designated capacities shall prevail.

1.04 COMMISSIONING

A. The Contractor shall provide all system commissioning services as required by section C408 of the 2018 International Energy Conservation Code (IECC). Electrical power and lighting systems shall comply with IECC section C405.

B. Commissioning, as outlined in IECC section C408 shall include the following:
1. A commissioning plan.
2. Functional performance testing for all lighting controls.
3. A preliminary commissioning report.
4. Final documentation including drawings, O&M manual(s), T&B report, and final commissioning report.

PART 2 - PRODUCTS

2.01 SHOP DRAWINGS AND SUBMITTALS

A. Submit Shop Drawings for all material furnished under this division of the work. Refer to the General Requirements for additional requirements. In addition to the quantity of Shop Drawing copies required by the General Requirements, furnish one additional copy for the Electrical Engineer's file. No material shall be fabricated, delivered to the jobsite, or installed which the Architect through Shop Drawing submittals has not approved.

B. The submittals shall include sufficient descriptive material, such as catalog cuts, diagrams, and other data published by the manufacturer, as well as evidence of compliance with safety and performance standards, to demonstrate conformance to the specification requirements; catalog numbers alone will not be acceptable. The data shall include the name and address of the nearest service and maintenance organization that regularly stocks repair parts.

C. Deliver Shop Drawings to the Architect in sufficient time to avoid delay of the project. Group Division 26 submittals as identified below, submit sections not included in these groupings separately. The Electrical Contractor shall acknowledge receipt of all Division 23 mechanical equipment submittals and confirm the overcurrent protection requirements of the project specific HVAC equipment has been coordinated with the distribution equipment prior to submitting for approval. All proposed changes to the overcurrent protection devices shall be clearly identified in the distribution equipment submittal.
   1. Distribution Equipment – Low Voltage
      a. Section 26 24 16 - PANELBOARDS
      b. Section 26 28 13 - FUSES
      c. Section 26 28 16 - OVERCURRENT PROTECTIVE DEVICES
      d. Section 26 28 17 - DISCONNECT SWITCHES
      e. Section 26 29 13 - MOTORS, MOTOR STARTERS AND CONTROLS
      f. Section 26 43 13 - SURGE PROTECTION DEVICES (SPDs)
   2. Lighting
      a. Section 26 09 24 - OCCUPANCY SENSORS
      b. Section 26 09 27 - LIGHTING CONTROL SYSTEM
      c. Section 26 51 13 - LIGHTING

D. Submit samples for approval when requested by the Architect.

E. Before submitting Shop Drawings for review, examine them and verify that they correctly represent the material or equipment intended for this project. The Contractor's review of Shop Drawings is not intended to take the place of the review of the Architect, and Shop Drawings which have not been reviewed by the Architect shall not be used in fabricating or installing any work.

F. List deviations and exceptions from the specified equipment in writing. Failure to do so will be cause for rejection of submittals. Contractor agrees that if deviations, discrepancies, or conflicts between Shop Drawing submittals and the Contract Documents are discovered either prior to or after Shop Drawing submittals are reviewed by the Architect, the Contract Documents shall control and shall be followed, unless deviations have been specifically approved by the Architect.

G. The review of Shop Drawings or catalog data by the Architect shall not relieve the Contractor from responsibility for deviations from plans and specifications unless he has, in writing, specifically called attention to such deviations at the time of submission and has obtained the permission of the Architect thereon; nor shall it relieve him from responsibility for error of any kind in Shop Drawings. When the Contractor does call such deviations to the attention of the Architect, he shall state in his letter whether or not such deviations involve any extra cost. If this is not mentioned, it will be assumed that no extra cost is involved for making the change.

H. Contractor agrees that Shop Drawing submittals reviewed by the Architect are not change orders; that the purpose of Shop Drawing submittals by the Contractor is to demonstrate to the Architect that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.

2.02 STANDARDS FOR MATERIALS

A. It is the intention of these specifications to indicate a standard of quality for all materials incorporated in this work. Manufacturer's names and catalog numbers are used to designate the item of equipment or material as a means of establishing grade and quality. Where several manufacturers are named, only the named manufacturer's products will be considered and the Contractor's bid shall be based on their product.

B. Where the phrase 'or approved equivalent' or 'or equivalent' or 'equivalent to' or 'accepted substitute' is used in these specifications, the names or name mentioned are to be used as a basis of quality. Other manufacturers will be considered if the quality of the proposed material is equivalent to that of materials named, in the opinion of the Architect. Such unnamed manufacturers' products will, however, be considered as substitutions and shall not be used as a basis for bidding.

C. Basis of quality shall include material, workmanship, weight, finishes, and gauges of material, appearances, capacity and performance. Manufacturer's representation as to availability of equipment, replacement parts and service personnel in the area will be a factor in consideration of submittals.

D. All materials shall be fully warranted.

E. Furnish standard products and manufacturers regularly engaged in production of such equipment.

F. Furnish manufacturer's latest standard design.

G. All equipment shall conform with applicable IEEE, UL, ANSI and/or NEMA Standards.

H. Obtain manufacturer's recommendations and instructions for all installed equipment including installation instructions, preparation cleaning, tests and preservice checks, and then ensure all have been performed prior to completion of work.

2.03 SUBSTITUTIONS

A. The Architect prior to installation shall approve substitutions of equipment. Substitution of equipment shall be in accordance with Division 01 of the specifications.

B. When alternate or substitute materials and equipment are used, the Contractor shall be responsible for space requirements, configurations, performance, changes in bases, supports, structural members and openings in structure, and other apparatus and trades that may be affected by their use.

C. Contractor shall bear all additional costs resulting from the use of substituted materials. Such changes shall be at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 COORDINATION

A. Coordinate and direct the work under this division of the specifications with the work under other divisions of the specifications. Examine the Contract Documents and report any discrepancies between divisions of the work to the Architect and obtain written instructions for changes necessary in the work.

B. Before installation, make proper provisions to avoid interferences with the work under other divisions of the specifications. Changes required in the work of the Contractor caused by his neglect to do so shall be made by him at his own expense.

C. Harmonize the work under this division with the work under other divisions of the specifications such that it may be installed in the most direct and workmanlike manner without hindering, handicapping, or conflicting with the work under other divisions of the specifications. Piping interferences shall be handled by giving precedence to pipelines that require a stated grade for proper operation.

3.02 PERMITS AND FEES

A. Secure and pay for all necessary permits, licenses and inspections required by law for the completion of the Work. Secure and pay for all certificates of approval that are required and deliver them to the Architect before final acceptance of the Work.

B. If a utility company in connection with the work under this division makes any charges, the Contractor shall advise the Owner, so that the Owner can pay these charges. Advise the Owner of these charges in a timely manner, so as not to delay construction of the project.

3.03 QUALITY ASSURANCE

A. Use adequate quantities of skilled workmen who are trained and experienced in their crafts and who are familiar with the specified requirements and methods needed to perform the work in this division.

B. Install materials and equipment based upon actual dimensions and conditions at the project site. Field measure for materials or equipment requiring exact fit.

C. Be responsible for the proper location and sizes of all slots, holes or openings in the building structure pertaining to the work in this division, and for the correct location of pipe sleeves.

D. Perform work in accordance with good commercial practice. The good appearance of the finished work shall be of equivalent importance with its operation.

E. Isolate all conduit, transformers and motors to insure an acceptable noise level free from objectionable vibration for all systems.

3.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Follow the manufacturer's directions in the delivery, storage and handling of equipment and materials.

B. Equipment and materials shall be tightly covered and protected against dirt, water, chemical or mechanical injury and theft. Damaged equipment will not be accepted.

C. After materials are installed, protect the installation until the work is completed and accepted by the Owner.

3.05 CLEANING UP

A. Remove all shipping labels, dirt, paint, grease and stains from all equipment under this division of the Work. Remove debris as it accumulates. Upon completion of the Work, clean all electrical equipment and the entire electrical installation in order to present a first class electrical installation suitable for occupancy. No loose parts, scraps, tools nor debris shall be left on the premises.

3.06 ELECTRICAL SERVICE FOR TESTING

A. Construct sufficient temporary electric service and connect to refrigeration machines, related pumps, fans, fan coil units, elevators and other equipment furnished under other divisions of the specifications such that the equipment installers may begin testing 30 workdays before job completion deadline.

B. Notify the electric utility company with sufficient time in advance so they can construct their portion of the permanent electric service entrance to this project. If the electric utility company indicates that permanent service will not be installed when needed, notify the Architect in writing immediately.

3.07 CUTTING AND PATCHING

A. Be responsible for the cost of cutting and patching required in connection with the work under this division of the specifications.

B. Coordinate the work to eliminate unnecessary cutting of construction. Where it becomes necessary to cut through walls, floors, ceilings and other construction to permit installation of the work, or to repair defective work under this division, the costs for such cutting and patching shall be included in this division of the work. Comply with other applicable divisions of the specifications concerning the quality of cutting and patching.

C. Where openings are cut through masonry walls, provide lintels or structural supports to protect the remaining masonry. Provide adequate support during the cutting operation to prevent any damage to the affected masonry.

D. Cutting of structural members is not permitted unless the Architect grants specific written permission.

3.08 FLASHINGS, SLEEVES, INSERTS

A. Be responsible for maintaining the integrity of the waterproofing of conduit penetrations through roofs, exterior walls and floors.

B. Be responsible for the installation of counterflashing of roof penetrations to provide a weatherproof installation.

C. Install 22 gauge galvanized sheet iron sleeves for each conduit passing through floors. Extend sleeves 1-1/2 in. above the floor slab and cement watertight. The sizes of sleeves shall be installed to permit the subsequent insertion of the proper size conduits or raceways.

D. Install galvanized wrought iron pipe sleeves around conduits and raceways that pass through concrete beams or walls and masonry exterior walls. The inside diameter of these sleeves shall be at least 1/2 in. greater than the outside diameters of the service pipes. After the pipes are installed in these sleeves, fill the annular space between pipes and sleeves with mastic. The completed installation shall be watertight.

E. Be responsible for maintaining the fire rating of penetrations through walls, floors and ceilings.

F. Waterproofing and fireproofing work shall conform to the requirements of other applicable sections of the specifications.

3.09 FOUNDATIONS

A. Be responsible for the installation of steel reinforced concrete foundations below all floor-mounted switchboards, panelboards, motor control centers, transformers and other floor mounted electrical equipment.

B. Concrete foundations shall not be less than 4 in. high. All top edges shall be neatly chamfered.

C. Concrete foundations shall be 3 in. wider and 3 in. longer than the base of the equipment being installed.

D. All concrete work shall be steel reinforced with a minimum of 6 in. by 6 in., No. 6 mesh and shall conform entirely to the requirements of the other sections of the specifications describing this class of work.

E. Be responsible for the installation of steel reinforced concrete piers for pole-mounted lighting fixtures. Neatly chamfer top edges and conform to the requirements of the other sections of the specifications describing this class of work. Remove all form marks, burrs and imperfections from all exposed surfaces for a neat and appealing appearance.

3.10 PAINTING

A. Maintain original factory finish on all material and equipment installed under this division of the work unless specifically noted otherwise within the Contract Documents. Should the finish be marred in transit or during installation, it shall be re-finished to present a neat, workmanlike appearance. Leave equipment clean and free from any grease, dirt and rust and in a suitable condition for painting.

3.11 EXCAVATION AND BACKFILLING

A. Be responsible for all excavating and backfilling necessary for the installation of the work under this division. Include shoring and pumping in ditches to keep them in dry conditions until the work has been installed. Perform all shoring required to protect the excavation and safeguard employees.

B. Make excavations to the proper depth, with allowances made for floor slabs, forms, beams, etc. Compact the ground under conduits before conduits are installed. Obtain approval of excavation routing from the Architect prior to executing the work.

C. Install exterior conduits with a minimum of 24 in. of cover below the finished grade, unless otherwise indicated.

D. Use selected soil for backfilling, free from rocks and debris, pneumatically tamped with 6 in. layers to secure a field density ratio of 90 percent as defined by ASTM Designation D698-57T (Proctor Soil Compaction Test).
E. Remove from the site excavated materials not suitable for backfill and not used in the backfill.
F. Field check and verify the locations of all underground utilities. Avoid disturbing these as far as possible. In the event existing utilities are damaged, they shall be repaired to make their operation equivalent to the existing condition before any trenching was started.
G. Replace concrete, curbs, paving and other surface improvements cut during excavation to their original condition. In a lime-stabilized area, the lime stabilization shall be fully restored after the excavation is complete.
H. Refer to Section 26 05 33 for marking underground electrical work.

3.12 IDENTIFICATION OF ELECTRICAL EQUIPMENT

A. Identify electrical equipment in accordance with the NEC, local authorities and in accordance with the requirements of the Contract Documents.
B. Use laminated three-ply, engraved plastic nameplates with black surface and white interior core, at least 1/16 in. thick. Engraved lettering shall be condensed gothic at least 1/4 in. high and properly spaced for legible and easy reading. Attach plates to equipment with chromium-plated screws. Adhesive attachment is not acceptable. Identify the following items with engraved nameplates, located as follows:
    1. Each switch/fuse unit or circuit breaker in each main panel and each distribution panel - adjacent to switch/fuse unit or circuit breaker.
    2. Spares shall be labeled 'Spare'.
    3. Each branch circuit panel - on panel trim cover immediately above panel door.
    4. Each safety switch, relay cabinet, time clock - on outside of cover. Include the power source on safety switches.
    5. Each exhaust fan switch - custom engraved on outside of switch coverplate (high and low if required).
    6. Each motor starter - on outside of cover.
    7. Each motor starter in motor control center on outside of cover.
    8. Outside light switches - custom engraved on outside of switch coverplate.
    9. Any switch for load that cannot be seen from the control point - custom engraved on outside of switch coverplate.
    10. Engrave coverplates for wiring devices served by emergency power systems with panel designation and circuit number(s) connected to the devices. Fill engraving with indelible black ink.
C. Receptacles and other electrical devices as indicated on plans.
D. Custom engraving on cover plates for items noted above shall be equivalent to custom engraving as performed by Hubbell, or accepted substitute.
E. Install adhesive arc flash warning labels on all equipment as required by the latest NFPA 70E. Each label shall show specific and correct information for specific equipment based on its arc flash calculations. Labels shall show the followings:
    1. Nominal system voltage.
    2. Equipment/bus name, date prepared, and preparer's name and address.
    3. Arc flash boundary.
    4. Available arc flash incident energy and the corresponding working distance.
    5. Minimum arc rating of clothing.
    6. Site-specific level of PPE.

F. Branch circuit panelboard directories shall be completely and properly typewritten, including room numbers. Room numbers and names shall be as finally designated at the jobsite.

G. Refer to other sections of the specifications for conductor color-coding requirements.

H. Refer to Section 26 05 33 for identifying of underground electrical work.

3.13 BALANCING OF PANELS

A. At the completion of the installation of the electrical system, check each phase of all panels under full load and arrange loads such that all phases carry the proper proportion of load. Submit load readings to Engineer for review as part of project close out documentation.

3.14 LOCKING OF ELECTRICAL FACILITIES

A. Provide padlocks for exterior electrical facilities subject to unauthorized entry.

B. Furnish locks to match Owner's locking system. Key all locks alike.

C. Furnish Owner with two keys per lock up to a quantity of ten keys.

D. Install locks immediately upon installation of electrical facility.

3.15 ACCESS DOORS

A. Wherever access is required in walls, ceilings, or soffits to concealed junction boxes, pull boxes or other electrical equipment installed under this division, provide and install access doors as indicated herein.

B. Access doors shall be approved by Architect prior to installation and shall only be installed where no means to reroute the access requirement is an option.

C. Furnish and install hinged access door and frame with flush latch handle as follows:

1. Plaster surfaces - Milcor Style K, or accepted substitute.
2. Ceramic tile or drywall surface - Milcor Style M (with 'B' label where required), or accepted substitute.
3. Install panels in locations approved by the Architect and paint as directed.

3.16 RECORD DOCUMENTS

A. Job set: Promptly following receipt of the Owner's Notice to Proceed, secure from the Architect at no charge to the Contractor, one complete set of all Documents comprising the Contract.

B. Final Record Documents: At a time nearing the completion of the work, secure from the Architect at no charge to the Contractor one complete set of sepia transparencies of all Drawings in the Contract.

C. Maintenance of Job Set: Immediately upon receipt of the job set described in paragraph above, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET".

D. Preservation:

1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for the new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Architect.
2. Do not use the job set for any purpose except entry of new data and for review by the Architect, from start of transfer of data to final Project Record Documents.
3. Maintain the job set at the site of Work where the Architect designates that site.

E. Making Entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
2. Date all entries.
3. Call attention to the entry by a 'cloud' drawn around the area or areas affected.
4. In the event of overlapping changes, use different colors for the overlapping changes.

5. All equipment shall be clearly indicated in its installed location. Exposed items or those easily accessible, as above lay-in ceilings, may be located to scale. Concealed items not readily accessible, such as underground piping, shall be located by dimension.

F. Transfer of Data to Final Project Documents:
   1. Approval of recorded data prior to transfer:
      a. Following receipt of the transparencies described above, and prior to beginning transfer of recorded data thereto, secure the Architect's approval of all recorded data.
      b. Make required revisions.
   2. Transfer of Data to Drawings:
      a. Carefully transfer change data shown on the job set of Record Drawings to the corresponding transparencies, coordinating the changes as required.
      b. Clearly indicate at each affected detail and other drawing a full description of changes made during construction, and the actual location of items described above.
      c. Call attention to each entry by drawing a 'cloud' around the area or areas affected.
      d. Make changes neatly, consistently, and with the proper media to assure longevity and clear reproduction.

G. Review and Submittal:
   1. Submit the completed set of Project Record Documents to the Architect as described above.
   2. Participate in review meetings as required.
   3. Make required changes and promptly deliver the final Project Record Documents to the Architect.

3.17 OPERATIONS AND MAINTENANCE DATA

A. Accumulate, as the job progresses, the following data, in duplicate, prepared in a neat brochure or packet folder, and deliver to the Architect for checking and subsequent delivery to the Owner.
   1. Manufacturers' warranties, guarantees, service manuals, and operating instructions for equipment and materials covered by this division of the specifications.
   2. Copies of approved Shop Drawings.
   3. Any and all other data and/or Drawings required during construction.
   4. Repair parts list of all major items and equipment including name, address, and telephone number of local supplier and agent.

3.18 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers or technicians acceptable to the Architect to instruct representatives of the Owner in the complete and detailed operation of each item of equipment, and each system. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a Letter of Release, acknowledged by the Owner or his Authorized Representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. Be responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, follow the written operating and maintenance manuals in all instances, and familiarize the Owner's personnel with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturers' operation and maintenance manuals, parts lists (with sources identified), and other data as appropriate for each system, and as required elsewhere in the Specifications to be furnished to the Owner prior to final acceptance of the project.

3.19 LOCAL PARTS AND SERVICE

A. Each item of equipment furnished on this project shall have local representation, factory-authorized service, and an adequate stock of repair parts. "Local" shall be defined, for this purpose, as "within 150 miles of the project site".

3.20 INSTALLATION INSPECTIONS AND CERTIFICATIONS

A. Obtain timely inspections of the installation by the constituted authorities. Remedy any deficiencies to the satisfaction of the inspection authority.

B. Upon final completion of the Work, obtain certificates of acceptance from the constituted authorities. Deliver the certificates to the Architect for transmission to the Owner.

3.21 OPERATION PRIOR TO ACCEPTANCE

A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, he may do so provided that he properly supervises the operation and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, clean the equipment properly; make required adjustments, and complete punch list items before final acceptance by the Owner.

B. The date of acceptance by the Architect, for beneficial use by the Owner, shall be the beginning date of the warranty period.

3.22 ACCEPTANCE OF THE WORK

A. The Work, when completed, will be accepted in a finished, perfect and undamaged state only. Provide for protection of the Work during its progress, and if damaged, do all patching or replacing necessary to its full and satisfactory completion.

3.23 WARRANTY

A. Furnish a written certificate, guaranteeing all materials, equipment and labor to be free of all defects for a period of one year from the date of final acceptance by the Owner of the Work, and guarantee that if any defects appear within the stipulated guarantee period, such work shall be replaced without charge.

B. This guarantee shall be extended to include the capacity and integrated performance of all component parts of the various systems.

C. Lamps for light fixtures shall be excluded from the guarantee requirements of this section.

3.24 FINALLY

A. It is the intention that this Specification provide a complete installation. Include all accessory construction and apparatus necessary to the operation and testing of the work under this division. The omission of specific reference to any part of the work necessary for such complete installation shall not relieve this Contractor from furnishing and installing such parts.

END OF SECTION

SECTION 26 05 11
WORK IN EXISTING BUILDING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment, and appliances required in conjunction with the work in existing buildings as indicated in the Contract Documents.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use materials to match existing construction unless specified elsewhere in these Contract Documents. Materials shall comply with local codes, be UL listed, and be properly applied for their intended function.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS

A. Inspect the jobsite prior to bidding and be familiar with all existing conditions. Include the cost of the work required to accommodate the existing conditions in the bid proposal.

B. Obtain data related to existing facilities from existing documents, measurements, notations, photographs, surveys and other observations at the site.

C. Relocate existing items as required to accommodate the new construction. Remove, relocate and reconnect equipment and accessories that are to be reused.

D. Coordinate the Work with other divisions of the specifications. Determine which items and equipment are to remain, to be relocated or be removed, and perform all work consistent with the Scope of Work.

E. Loads that exist and are to remain shall be connected to the new distribution system as shown on the Drawings or as required to maintain their proper operation.

F. Refer to other divisions of the specifications and determine equipment that requires power to be disconnected, or power to be relocated and disconnect power and relocate power to this equipment.

G. Remove all conductors and exposed conduit rendered unused back to the source of supply.

H. Perform splices as required to maintain circuit continuity to existing devices or equipment to remain in service.

3.02 DISRUPTION OF EXISTING FUNCTIONS

A. Access: Access to and use of the existing facilities and site will be restricted, and shall be under the direction and control of the Owner.

B. Disruptions: Maintain existing electrical, communications, alarm, and other existing systems, and maintain existing functions in service except for scheduled disruptions. Where existing functions to remain in use are disrupted, they shall be fully restored after disruption, in full compliance with this division of the specifications for new work.

C. Scheduling of Disruptions: Seek and obtain approval two weeks in advance of the event date. Indicate date of event, starting time, and duration of each required disruption.

D. Notice of Disruption: Date, time and duration of each disruption shall be subject to the Owner's prior approval, and shall include the following information in the form of a memorandum submitted by the Contractor to the Architect for approval by the Owner:

		STARTING		
	FACILITY/SYSTEM	DATE	TIME	DURATION

E. Emergency Disruptions: When circumstances preclude obtaining advance approval as specified above, make request immediately upon knowledge of the requirement, and perform work so as to cause the minimum amount of disruption, for the minimum duration.

F. Notification: Notify the Architect and the Owner immediately by telephone and then in writing, as changes and additions to the scheduled disruption requirements become known.

G. Duration: Complete as large a portion of the work as possible before initiating disruption and perform only that work necessary so as to minimize duration of disruption. Maintain adequate personnel, supplies, materials, equipment, tools, and other resources at job site to avoid unnecessary delay in resumption of normal service.

3.03 SALVAGE, DEMOLITION AND RELOCATION

A. General

1. Modify, remove, or relocate materials and items indicated in the Contract Documents and required by the installation of new facilities.
2. Working jointly with the work under other divisions of the specifications establish and mark salvage and demolition items before commencing work; report items scheduled for relocation, reinstallation or reuse, which are found to be in damaged condition; await further instructions from the Owner's Representative and/or the Architect before commencing with work.
3. Owner shall have first right of refusal for all material and equipment. Deliver salvaged material accepted by the Owner to destinations on the premises as directed and remove material rejected by the Owner from the site.

B. Relocations

1. Make minor relocations necessitated by the conditions at the site or as directed by the Architect, without additional cost to the Owner.
2. Repair and restore to good functional condition equipment, materials and items scheduled for relocation, which are damaged during dismantling or reassembly operations.
3. New materials and items of similar design and quality may be substituted for materials and items indicated to be relocated upon approval of shop drawings, product data, and samples.
4. Remove carefully, in reverse order to original assembly or placement, items that are to be relocated.
5. Protect items until relocation is complete.
6. Clean and repair items to be relocated, and provide new materials, fittings, and appurtenances required to complete the relocations and to restore items to good operating order.
7. Perform the relocation work in accordance with applicable sections of these specifications, utilizing skilled workers.

C. Relocating Devices: Remove and reinstall, in locations designated by the Owner's Representative and the Architect, temperature control system devices, relays, wire, conduit, fixtures, equipment and other devices required for the operation of the various systems that are installed in existing-to-be-removed construction.

3.04 EXISTING RACEWAYS

A. Reuse raceways where possible and where permitted by local codes. Rework raceways to meet code requirements. Secure all raceways that are not properly supported. Paint raceways when exposed to view to match surroundings if existing finish is damaged or soiled.

B. Fasten existing boxes and raceways securely to provide proper support.

3.05 NEW RACEWAYS

A. Provide new raceways where required to provide wiring as indicated in the Contract Documents.

B. Where raceways must be exposed to view as first permitted, and accepted by Engineer and Architect, use wiremold, securely fastened, and painted to match surroundings. Provide number of coats of paint as required to cover prime coat of original finish of wiremold.

3.06 EXISTING WIRING DEVICES

A. Inspect existing wiring devices, which are to be reused, for damage and replace as necessary.
B. Clean existing wiring devices, to be reused, to a "like- new" condition.
C. Replace damaged wiring devices cover plates with new cover plates that match the existing.
D. Tighten wire terminations at reused wiring devices.
E. Replace existing lighting switches rated 15 amperes with new switches rated 20 amperes when the load to be controlled exceeds 12 amperes.
F. Replace existing receptacles rated 15 amperes with new receptacles rated 20 amperes when the load to be connected exceeds 12 amperes.

3.07 EXISTING TELEPHONE OUTLETS

A. Inspect existing telephone outlets for damage. Repair or replace damaged outlets.
B. Clean existing telephone outlets.
C. Replace damaged telephone outlet cover plates to match existing.
D. Provide new telephone outlets and conduits to above the ceiling line at locations where existing telephone wiring is not in conduit.

3.08 EXISTING LIGHTING FIXTURES

A. Service existing lighting fixtures as follows:
   1. Clean reflective surfaces, lenses, and sight exposed portions.
   2. Re-lamp with new lamps of the same types removed.
   3. Repair or replace lamp holders, ballasts, wiring, and door latching and hinging mechanisms.
   4. Reconnect to branch circuit wiring, tighten connections.
B. Existing lighting fixtures may be replaced with new fixtures in lieu of the actions required by Paragraph 3.8 A above, if, in the Contractor's opinion, costs to the Owner would be lower.

3.09 EXISTING CEILINGS

A. Provide a typewritten list of existing damaged ceilings and ceiling tiles. Disregard rooms in which ceilings are to be repaired and replaced. Correlate list to room numbers indicated on drawings.
B. Mark damaged ceilings and ceiling tiles with easily removable red "stick-on" labels, minimum size two square in.
C. Submit list prior to commencing work. Do not start work until Architect and Owner review list; otherwise repair and replace damaged ceilings and ceiling tiles.

3.10 EXISTING PANELBOARDS

A. Service existing panelboards to be reused as follows:
   1. Clean interiors and exteriors.
   2. Touch-up damaged finishes with manufacturer's matching touch-up paint.
   3. Inspect for component damage and repair or replace as necessary.
   4. Tighten conduit and wire terminations.
   5. Verify panelboards and panelboard feeders are of adequate capacity for loads to be served as follows:
      a. Activate loads connected to panelboards to simulate 100 percent demand.
      b. Measure and record amperage readings of phase and neutral conductors of panelboards feeders.
      c. Provide typewritten record of recorded measurements to the Engineer for review.

6. Rebalance loads as specified in other sections of the specifications to provide for evenly balanced phases.
7. Provide new typewritten circuit directories.
8. Provide new panelboard identification labels if panelboard designation changes or if no labels exist.

3.11 EXISTING WIRING

A. Inspect existing wiring to be reused for damage. Repair or replace damaged wiring.
B. Assure integrity of existing wiring insulation as follows:
   1. Megger wiring phase-to-phase, phase to neutral, phase to ground, and neutral to ground.
   2. Record megger results. Provide typewritten record of results to the Architect for review.
   3. Repair defective insulation to a dielectric value equivalent to that of wire of the same type.
   4. Existing wiring may be replaced with new wiring if, in the Contractor's opinion, costs to the Owner would be lower.
C. Secure and label existing wiring that is to be disturbed.
D. Tighten existing wiring terminations and connections.

3.12 EXISTING FOUNDATIONS AND FLOORS

A. Prior to coring, penetrating or cutting of existing foundations or floors, the Contractor shall notify the Architect in writing and request all as-built and building record drawings showing the location of post tension cables in slabs and subsequent floors. In the event post tension cables do exist in the building, the Contractor shall X-ray the area to be cut, cored or penetrated. Two copies of the X-ray shall be forwarded to the Architect and written approval issued to the Contractor prior to proceeding with the work.
B. If no as-built or record building drawings are available, then the Contractor shall X-ray the area to be cut, cored or penetrated. Two copies of the X-ray shall be forwarded to the Architect and written approval issued to the Contractor prior to proceeding with the work.

END OF SECTION

SECTION 26 05 12
MECHANICAL AND ELECTRICAL COORDINATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.
B. Refer to Section 21 00 10 - BASIC FIRE PROTECTION REQUIREMENTS.
C. Refer to Section 22 00 10 - BASIC PLUMBING REQUIREMENTS.
D. Refer to Section 23 00 10 - BASIC MECHANICAL REQUIREMENTS.

1.02 SUMMARY

A. This Section describes the coordination between the Fire Protection, Plumbing, Mechanical and Electrical portions of the work.
B. This Section is included under the Division 21 portion of the Specifications as Section 21 05 12, under the Division 22 portion of the Specifications as Section 22 05 12, under the Division 23 portion of the Specifications as Section 23 05 12, and under the Division 26 portion of the Specifications as Section 26 05 12.

1.03 WORK INCLUDED

A. Responsibility: Unless otherwise indicated, motors and controls shall be furnished, set in place and wired in accordance with the following schedule. **This schedule may include equipment and systems that are not required for this project. Only the equipment and systems that are required on the drawings and/or specified elsewhere will be required by this section:**

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
1.	Equipment Motors	21/22/23	21/22/23	26
2.	Magnetic Motor Starters			
	a. Automatically controlled, with or without HOA switches	21/22/23	26	Notes 1,3,5
	b. Automatically controlled, with or without HOA switches and furnished as part of factory wired equipment	21/22/23	22/23	Notes 1,3,5
	c. Manually controlled	21/22/23	26	Notes 1,3,5
	d. Manually controlled and furnished as part of factory wired equipment	21/22/23	26	Notes 1,3,5
	e. Furnished in Motor Control Centers	26	26	Notes 1,3,5
3.	Variable Speed (Frequency) AC Drives	22/23	26	Notes 1,4,5
4.	Line voltage thermostats, time clocks, etc., not connected to control panel systems	23	26	23
5.	Electric thermostats, time clocks, remote bulb thermostats, motorized valves, float controls, etc. which are an integral part or directly attached	22/23	22/23	22/23

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
	to ducts, pipes, etc.			
6.	Temperature control panels and time switches mounted on temperature control panels	23	23	23
7.	Motorized valves, motorized dampers, solenoid valves, EP and PE switches, etc.	23	23	Note 1
8.	Alarm bells furnished with equipment installed by Division 22 or 23	22/23	22/23	22/23
9.	Wiring to obtain power for control circuits, including circuit breaker	21/22/23	21/22/23	21/22/23
10.	Low voltage controls	21/22/23	21/22/23	21/22/23
11.	Fire protection system (sprinkler) controls	21	21	Note 8
12.	Fire and smoke detectors installed on mechanical units and in ductwork	28	23	Note 8
13.	All relays required for fan shutdown, motorized dampers, smoke control devices, and other items integral with HVAC equipment to provide operation and control of HVAC equipment	23	23	Note 1
14.	Smoke dampers, and combination fire/smoke dampers	23	23	Note 7
15.	Boiler and water heater controls, boiler burner controls panels	22/23	22/23	22/23
16.	Pushbutton stations, pilot lights	22/23	22/23	22/23
17.	Heat Tape	21/22/23	21/22/23	26
18.	Disconnect switches, manual operating switches furnished as a part of the equipment	21/22/23	21/22/23	Notes 1,5
19.	Disconnect switches, manual operating switches furnished separate from equipment	26	26	26
20.	Multispeed switches	23	23	26
21.	Thermal overloads	21/22/23	21/22/23	21/22/23
22.	Control relays, transformers	21/22/23	21/22/23	21/22/23
23.	Refrigeration cycle, cooling tower and controls	23	23	23
24.	Tamper switches for fire	21	21	28

	ITEM	FURNISHED UNDER DIVISION	INSTALLED UNDER DIVISION	WIRED AND CONNECTED UNDER DIVISION
	protection (sprinkler) system			
25.	Flow and/or pressure switches for fire protection (sprinkler) system	21	21	28
26.	Fire and jockey pump controllers and automatic transfer switch	21	21	Note 6
27.	Alarm bells or horns for fire protection (sprinkler) system	21	21	28
28.	Generator (underground) fuel tank	22	22	--
29.	Generator fuel level indicator	22	22	26
30.	Generator fuel piping from tank to generator	22	22	--
31.	Underground fuel tank leak detection and monitoring system	22	22	22

NOTES:	(1)	Power wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 26; control wiring as defined in Section 26 29 13 of the specifications shall be provided under Division 21/22/23.
	(2)	Wiring from alarm contacts to alarm systems provided by Division 26, wiring from auxiliary contacts to air handling system controls provided by Division 23. Division 26 shall provide power to smoke detector. Smoke detectors required for all air handling systems 2000 CFM or greater. Refer to other Division 23 specifications, Division 26 and Drawings for more specific requirements.
	(3)	For requirements for Magnetic Motor Starters, refer to Section 238965.
	(4)	For requirements for Variable Speed (Frequency) AC drives, refer to Section 238965.
	(5)	Disconnect switches, operating switches, starters and other similar items that are factory-mounted, as a part of complete assembly, shall comply with applicable provisions of the National Electric Code. All such disconnect switches shall be fused.
	(6)	Power wiring from energy source to controllers and automatic transfer switch shall be provided under Division 26. Interconnection power and control wiring from controllers and automatic transfer switch to pumps shall be provided under Division 21, 22 or 23 and conforming to Division 26 specifications. Control wiring from automatic transfer switch to generator starter shall be provided under Division 26.
	(7)	Division 26 will provide power to all smoke and combination fire/smoke dampers, and Division 28 will provide control for all such dampers using area smoke detectors.

	(8)	Wiring for sprinkler system controls to be provided by Division 21. Wiring from devices to Fire Alarm System to be provided by Division 28.

B. CONNECTIONS: Make all connections to controls that are directly attached to ducts, piping and mechanical equipment with flexible connections.

C. PRECEDENCE
   1. In general, piping systems that require a stated grade for proper operation shall have precedence over other systems.
   2. Precedence for pipe, conduit and duct systems shall be as follows.
      a. Building lines
      b. Structural members
      c. Soil and drain piping
      d. Vent piping
      e. Steam piping
      f. Condensate piping
      g. Refrigerant piping
      h. Electrical bus duct
      i. Supply ductwork
      j. Return ductwork
      k. Exhaust ductwork
      l. Chilled water and heating water piping
      m. Automatic Fire Protection Sprinkler Piping
      n. Natural gas piping
      o. Domestic hot and cold water piping
      p. Electrical conduit
   3. Lighting Fixtures shall have precedence over air grilles and diffusers.

D. FINAL INSPECTION AND REPORT
   1. At the completion of the work, there shall be a meeting of the Fire Protection, Plumbing, Mechanical, Electrical Fire Alarm and Temperature Control Contractors, representatives of mechanical and electrical equipment manufactures whose equipment was actually installed on the project, and similarly-involved individuals, who shall thoroughly inspect all systems, and who shall mutually agree that all equipment has been properly wired and installed, and that all temperature and safety controls are properly functioning. A written report of this meeting, listing those in attendance, and the companies that they represent, shall be filed with the Owner and Architect or Engineer.

END OF SECTION

SECTION 26 05 19
WIRES AND CABLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of wire and cable systems as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide conductors made of soft-drawn-annealed copper with conductivity not less than that of 98 percent pure copper. Conductors #12 gauge and smaller shall be solid. Conductors No. 10 gauge and larger shall be stranded.

B. Utilize conductors with insulation rated at 600 volts and insulated with type 'THHN' insulation in dry locations and type "THWN" in wet locations . Wire in fixture channels and other special locations shall be as specifically rated for temperature in Article 300 in the NEC.

C. Minimum wire sizes shall be in accordance with other requirements of the specifications and as follows: For 20 ampere branch circuits #12 gauge, except that home runs greater than 50 ft. from the panel to the first outlet box on 120/208 volt shall be #10 gauge. Where home runs are greater than 100 ft. from the panel to the first outlet box, on 277-volt circuits wire shall be #10 gauge.

D. All wire shall be color-coded. Mark conductors on each end with a 1 in. band of colored pressure-sensitive plastic tape or by the use of brilliant waterproof lacquer, applied according to manufacturer's instructions. Colors for each phase and the neutral shall be consistent throughout the system in accordance with the requirements of this section.

E. Conductor sizes shown on the Contract Documents are selected based upon use with 75 degrees C terminations. Furnish terminations, which are UL listed for 75°C, or derate conductors for use at 60°C. Use of 90°C terminations is acceptable, but conductor must be sized at the 75°C rating. Do not use 90°C rating for conductors.

F. Armored cable types AC and BX are specifically not allowed.

G. Armored cable type MC is allowed for the following applications only:

1. Where installed within existing wall cavities to a point 12 inches maximum above the top of the wall.
2. Where installed above existing unaccessible ceilings to points 12 inches maximum beyond the edges of the existing ceiling.
3. Where installed in accessible ceiling spaces in lengths not exceeding six feet if allowed by local building codes.

PART 3 - EXECUTION

3.01 GENERAL WIRING METHODS

A. Place an equivalent number of conductors for each phase, neutral and ground of a circuit in same raceway or cable.

B. Do not share neutral conductors between branch circuits connected to single pole circuit breakers unless shown otherwise on drawings.

C. Splice only in junction or outlet boxes.

D. Neatly train and lace wiring inside boxes, equipment, and panelboards.

E. Make conductor lengths equal for parallel circuits.

F. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling #4 gauge and larger wires.

G. When inserting conductors in raceways, comply with the following:
   1. Raceways shall first be installed as a complete raceway system without conductors.
   2. Do not install pull wires and conductors until the raceway system is in place.
   3. Do not use cleaning agents and lubricants that have a deleterious effect on the conductors.
   4. Completely and thoroughly swab raceway system before installing conductors.

3.02 PHASING

A. Identify wire and cable for feeders and branch circuits for general power and lighting with a visible color code in accordance with the requirements of this section as follows:

120/208 Volt	277/480 Volt
Phase A - Black	Phase A - Brown
Phase B - Red	Phase B - Orange
Phase C - Blue	Phase C - Yellow
Neutral - White	Neutral - Gray
Ground - Green	

B. Provide green or bare grounding conductor identification for grounding conductors. Identification of all ungrounded conductors at junction boxes, wireways, and/or terminations may be by means of colored tape or painting when color-coded conductors as specified above are not available.

C. Phasing of the complete electrical installation shall be connected and maintained the same throughout the power distribution system. Where the project is an addition or modification to an existing facility, the electrical distribution system phasing shall be made the same as the existing.

D. Switchgear, safety switches, motor starters, plug-in type bus duct, lighting and power panels and power receptacles shall have all the same phase arrangements throughout the facility.

3.03 INSTALLATION

A. Install conductors in a neat and workmanlike manner to meet code requirements and make runs continuous without weld, splice, or joint between boxes. Do not install wires in conduit unless the entire system of conduit and outlet boxes is permanently in place. Pull conductors using a UL approved wire lubricant.

B. Provide conductors continuous from outlet to outlet with no splices except at outlets. Leave sufficient wire at all outlets to make connections without straining.

C. Deliver cable and wire to the project in original packages. Conductors with insulation showing deterioration within one year after final completion and acceptance of the Work shall be removed and replaced at no cost to Owner.

D. Thoroughly clean wires before installing lugs and connectors.

E. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

F. Terminate spare conductors with electrical tape.

G. Torque test conductor connections and terminations to manufacturer's recommended values.

H. Where outlets only are indicated, leave 48-in. leads of conductors, for connection to equipment. Identify all conductors' circuit numbers with Brady tape at terminals and junctions.

I. Where more than three current-carrying conductors are installed in a raceway, use larger size conductor and appropriate larger size raceway to comply with Article 310 of the National Electrical Code.

J. Where conductor is installed in an environment where the ambient temperature will exceed 86°F, use larger size conductor and appropriate larger size raceway to comply with Article 310 of the National Electrical Code.

K. Test all circuits for grounds. Light and test each lamp. Prove and test energy available at the load side of disconnect switches and at the final point of connection to driven equipment. Make all necessary and reasonable tests as required by the Architect to prove the integrity of work and leave the complete electrical installation ready for operation.

L. Where MC cable is allowed for use on this project in Part 2 of this specification section:
   1. Install MC cable in accordance with NEC, Article 330.
   2. Provide fittings UL listed for use with MC cable.

END OF SECTION

SECTION 26 05 20
WIRE CONNECTION AND DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of wire connections and devices systems as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Make cable and wire connections for splicing or terminating with compression deforming type connectors as manufactured by Burndy Corp., Thomas & Betts Co., Inc., Dossert Manufacturing Corp., Ilsco Corp., or accepted substitute. Connectors for cable sizes 250 Kcmil and larger shall be the long barrel type for double indentation. Soldered connections will not be permitted. Twist-on insulated connectors, of proper size, and resistant to vibration, may be used. Use twist-on connectors as manufactured by Minnesota Mining and Manufacturing Co., Thomas & Betts Co., Inc., Ideal Industries, Inc., or approved equivalent.

B. Provide terminal connectors with the hole sizes and spacing in accordance with NEMA standards. Provide terminal connectors with two holes in tongue for use on conductor sizes 250 Kcmil and larger. Terminal connectors are not required for connections to the circuit breakers in the lighting and/or receptacle panels.

C. Insulate connections made with non-insulated connectors with three layers of plastic tape, each layer being half-lapped. Use No. 35+ plastic tape as manufactured by Minnesota Mining and Manufacturing Co., or similar and equivalent plastic tape as manufactured by Plymouth Rubber Co.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Make all electrical power and control connections to equipment furnished under other divisions of the specifications and furnish wiring, conduit, outlet boxes, disconnect switches, etc., as required for same. Check General Construction, Controls, Plumbing, Heating, and Air Conditioning, etc. plans and specifications to determine the amount of such wiring required and include cost of same in bid. Verify locations, horsepower, voltages, etc., of all equipment as the job progresses. If a conflict arises in wiring, ask the Engineer immediately for clarification.

B. Provide branch circuits and connections to all motors furnished to this project. Provide all disconnect switches as shown and where required by national or local codes. In general, all wiring shall be in conduit, with a short section of flexible conduit at each motor. Securely attach conduit to flexible conduit. When the motor is an integral part of equipment, isolate with a short section of flexible metal conduit to prevent vibration and/or noise amplification to the building structure. If the motor is adjustable, an additional length of flexible metal conduit shall be installed at the motor. Connect a ground wire from the conduit termination to the motor frame on the inside of the flexible conduit. Use approved grounding lugs or clamps on the conduit connection.

C. Branch circuits and connections to all electrically operated equipment are included in this contract, whether or not specifically mentioned. Check, on the job, for further details on Plumbing, Heating, and Air Conditioning equipment as project progresses. Ground equipment in an approved manner.

D. Major equipment furnished under the mechanical and other sections of the specifications may require different rough-in requirements than indicated on the plans due to the 'or equivalent' equipment clause. Secure detailed drawings from the trade furnishing the equipment to determine actual rough-in locations, conduit and conductor requirements.

E. Before connecting equipment, check the nameplate data against the information shown on the Drawings. Call any discrepancies to the attention of the Architect.

END OF SECTION

SECTION 26 05 26
GROUNDING

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of a grounding system as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products used.

1.03 TESTS

A. Measure ground grid resistance with earth test megger and install additional ground rods and conductors as required until resistance to ground complies with Code requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide a grounding system that includes all connections and testing of ground rods, ground cables, ground buses, conduits, fittings, anchors, supports, thermite process materials and equipment, and other materials as required for a complete installation.

B. Provide ground cables composed of stranded bare copper of 98 percent conductivity encased in conduits above grade, or buried to a depth not less than 12 in. below grade. Install as required to provide sufficient mechanical protection.

C. Provide Thomas & Betts Co., Inc., Catalog No. 3951, or approved equivalent, ground fittings for bonding ground cable to its encasing conduit.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Ground electrical work in accordance with NEC Article 250, local codes as specified herein, and as shown on the Drawings.

B. Install ground cables continuous between connections. Splices will not be allowed except where indicated on the Drawings. Where ground cables pass through floor slabs, building walls, etc., and are not in metallic enclosures, provide with sleeves of approved nonmetallic material.

C. Bond rigid metal conduit and electrical metallic tubing with equipment grounding conductors. Make-up couplings wrench tight. Install grounding conductor in nonmetallic raceways and under floor ducts.

D. Install equipment-grounding conductors in all raceways.

E. Ground interior lighting fixtures with grounding conductor to rigid metal raceways serving them. Flexible metal conduit in lengths less than 6 ft. 0 in. may be used as grounding conductors when terminated with approved fittings on circuits of 20 amperes or less.

F. Where connections are made to motors or equipment with flexible metal conduit, grounding conductor shall be stranded copper conductor within the conduit, bonded to the equipment and to the rigid metal raceway system. Size conductor in accordance with NEC, Article 250.

G. At each convenience outlet, install a grounding clip attached to the outlet box and leave a sufficient length of No. 12 wire with green colored insulation to connect to the grounding terminal of the receptacle. Grounding clip shall be equivalent to Steel City Type G. This requirement may be deleted if automatic grounding clip receptacle meeting NEC Article 250.

3.02 COMMUNICATION GROUNDING

A. Telephone:

1. Provide one No. 4 THW to main service ground bus from each telephone equipment room. Leave 12 in. pigtail at telephone board.

B. Fire Alarm and Detection:

1. Provide one No. 6 THW in 1/2 in. conduit to nearest ground bus.

C. Television Distribution System:
   1. Provide one No. 6 THW in 1/2 in. conduit to nearest ground bus.

D. Public Address System:
   1. Provide one No. 6 THW in 1/2 in. conduit to nearest ground bus.

3.03 COORDINATION

A. Coordinate the work under this section with the work under other divisions of the specifications.

END OF SECTION

SECTION 26 05 27
SEALING OF PENETRATIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment and appliances required in conjunction with sealing of penetrations as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Samples: Provide samples upon written request.

B. Product Data: Manufacturer's specifications and installation instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Acceptable Manufacturers:

1. Caulk and Putty: 3M's No. CP-25 and No. CP-303 synthetic elastomers.
2. Wrap/Strip: 3M's No. FS-195 organic/inorganic, fire resistive sheet with aluminum foil on one side.
3. Composite Sheet: 3M's No. CS-195 organic/inorganic fire resistive elastomeric sheet, bonded on one side with 28-gauge galvanized steel and the other side with reinforced hexagonal shaped steel wire mesh and covered with aluminum foil.
4. Thunderline Model "LS/Link-Seal" seals, of the required size and number of links, shall be used on all conduit penetrations of exterior walls. Similar fittings by O.Z./Gedney shall be considered approved equivalents.

2.02 ROOF PENETRATION SYSTEMS

A. General: Construct roof penetration systems utilizing the “Alumi-Flash” system by Portals Plus, Inc., or equal by Thy-Curb.

B. Each roof penetration shall include a spun aluminum base (“High” size if required due to the existing roof construction and any insulation thickness) and an EPDM rubber cap. Each rubber cap shall have a pre-molded pipe opening and shall be selected based on the actual pipe or conduit size required at each location. Secure each rubber cap to each pipe or conduit with the manufacturer’s recommended stainless steel gear clamp.

C. Manufacturer: Subject to compliance with requirements, provide roof penetration systems of one of the following:

1. Portals Plus, Inc.
2. Thycurb Div.; Thybar Corp.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Review the detailed requirements of the UL through penetration fire stop assembly to be used and verify dimensional requirements such as maximum conduit size, conduit spacing, maximum opening size, minimum length of sleeve, etc.

B. For sealing of sleeves on or below grade and in wet locations, install link seals around all conduit penetrations properly sealing the annular space between the sleeve and the conduit to provide a waterproof seal.

C. For sealing of sleeves above grade and in dry/damp locations, use specified fire stop material and install per manufacturer's instructions and in conformance with UL requirements.

D. Attach an adhesive warning label identifying the fire stop assembly and warning against removal without proper resealing.

E. Seal floor, wall and ceiling penetrations or fire rated assemblies in above grade and in dry/ damp locations, both horizontal and vertical, utilizing intumescent (expand when heated) materials designed to be applied as a fire, cold smoke, noxious gas, and water sealant. Penetrations shall meet the requirements of ANSI/UL 1479 "Fire Tests of Through-Penetration Firestops".

END OF SECTION

SECTION 26 05 29
SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with installation of supporting devices as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Product Data:

1. Manufacturer's engineering brochures.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Kindorf

B. Unistrut

C. Superstrut

D. Powerstrut

2.02 MATERIALS

A. Continuous slotted channel: 12 gauge steel with electro-galvanizing and gold zinc dichromate barrier bases and dimensions as required for application.

B. Hanger rods: Continuous thread, electro-galvanized, steel, with gold zinc dichromate barrier, sizes as required for loads imposed.

C. Hex head cap screws and nuts: No. H-113 and No. 114, respectively.

D. One-hole pipe straps: Series HS-100, galvanized steel.

E. Single bolt channel pipe straps: Steel, with machine screw and nut, Series C-105 and Series C-106.

F. Lay-in pipe hanger: Series C-149.

G. Conduit and pipe hanger: Series 6H.

H. Beam clamps: Series 500, RC, EC and PC as applicable.

I. Concrete inserts, spot: Series D-256 or D-255.

J. Concrete inserts, channel: Series D-980 or Series D-986.

K. Riser clamps: Series C-210.

L. Cable supports: O.Z./Gedney Type S.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Carefully lay out supporting devices to coordinate with the work under other divisions of the specifications.

B. Securely fasten and support conduits and raceways to the building structure.

C. Suspend horizontal runs of conduits and raceways from the floor and roof construction by rod hangers spaced 10 ft. or less on centers for sizes 2-1/2 in. and greater, and 9 ft. or less on centers for 2 in. and smaller.

D. Fasten single runs of conduit to the structure with one-hole pipe straps and beam clamps or hang on rod hangers.

E. Support multiple runs of conduit and raceways from continuous channel inserts or from trapeze hangers constructed of rod hangers and channels.

F. Fasten single conduits to rod hangers with adjustable lay-in pipe hangers or for conduits of sizes 2 in. and smaller with Series 6H pipe hangers.

G. Fasten conduits to channels with pipe channel straps.

H. Support conduits and raceways within 3 ft. of each bend, of each termination, and at other intervals to maintain horizontal and vertical alignment without sag and deformation.

I. Do not use cable, strap, or wire hangers and fasteners.

J. Provide riser clamps for conduits at floor lines. Provide wire and cable supports in pull boxes for risers in accordance with NEC.

K. Install supports to permit equivalently distributed expansion and contraction of conduits and raceways with expansion joints. Use guides consisting of saddles, U-bolts and anchors designed for equivalent effectiveness for both longitudinal and transverse thrusts. Submit complete details for review.

L. Do not support conduits and raceways from equipment connections.

M. Provide special supports with vibration dampers to minimize transmission of vibrations and noises, where required.

N. Provide hangers, racks, cable cleats, and supports for wires and cables in cable chambers and other locations to make a neat and substantial installation.

O. Provide steel angle and channel supports to the floor and structure for panelboards, cabinets, pull and junction boxes. Provide independent support from entering conduits and raceways.

P. Provide supports as specified for conduits and raceways for outlet boxes and pull boxes 100 cubic in. and smaller.

Q. Paint all cuts, breaks, welds and other points where the rust inhibiting coating of supports is damaged.

R. Provide supports sized for the ultimate loads to be imposed.

S. Anchor supporting devices with:
   1. Wood screws on wood.
   2. Toggle bolts on hollow masonry.
   3. Bolts and expansion anchors in concrete or brick.
   4. Machine screws, threaded rods and clamps on steel.

T. Provide supports with hot-dipped galvanized finish in outdoor and wet locations.

U. Pipe and conduit supports:
   1. Single run pipe and conduits, 2-1/2 in. O.D. and less, shall have Type SS-8R/SS-8C as manufactured by Portable Pipe Hangers, Inc., or approved equivalent, spaced at maximum eight ft. on center and installed on roof pads if required by the roofing manufacturer.
   2. Multiple run pipe and conduits larger than 2-1/2 in. O.D. shall have Type PS, PSE, PP-10 with Roller, or PP-10 with Bar, as manufactured by Portable Pipe Hangers, Inc., or approved equivalent, spaced at maximum eight ft. on center and installed on roof pads if required by the roofing manufacturer. All conduits shall be held in place with clips on bars.

END OF SECTION

SECTION 26 05 32
PULL AND JUNCTION BOXES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of pull and junction boxes as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Pull boxes and junction boxes used on concealed runs of conduit in walls and over ceilings shall be of code gauge galvanized steel with sheet steel covers. Pull boxes in floors shall be of galvanized malleable cast iron, with gasketed covers. Exposed pull boxes or junction boxes installed outdoors shall be weatherproof and shall be provided with watertight gasketed covers fastened with corrosion resistant screws.

B. Pull Boxes and Junction Boxes: Metal construction conforming to National Electrical Code, with screw-on or hinged cover. Use hinged cover for boxes larger than 12 in. in any dimension.

C. Flush-Mounted Pull Boxes: Provide overlapping covers with flush-head cover retaining screws, prime coated.

D. Pull boxes where installed on exterior shall be NEMA 4X.

E. Pull boxes installed where subject to vehicular traffic shall be Tier 22 rated.

F. Boxes and Box Covers shall be painted to match color code below, unless exvluded for aesthetic purposes.

SYSTEM	CONDUIT BAND COLOR	BOX COVER	
		IDENTIFICATION	COLOR
FIRE ALARM	RED	FA	RED
EMERGENCY POWER (ALL VOLTAGES	WHITE	EM/ PANEL ID / CKT. NO.	WHITE
208/120V NORMAL POWER	BLUE	PANEL ID / CKT. NO.	BLUE
480/277V NORMAL POWER	YELLOW	PANEL ID / CKT. NO.	YELLOW
DATA, TELECOM, FIBER OPTIC, A/V	ORANGE	DATA, TELE, FIBER OPTIC, AV	ORANGE
HVAC CONTROLS	GREEN	HVAC	GREEN
SECURITY	PURPLE	SEC	PURPLE

PART 3 - EXECUTION

3.01 INSTALLATION

A. Use separate pull boxes and junction boxes for electric power, control, lighting, computer and communication systems.

B. Install pull boxes and junction boxes where required by the National Electrical Code and wherever required to overcome mechanical difficulties.

C. Install pull boxes in interior conduit at not more than 100 ft. apart when junction or outlet boxes do not break conduit runs.

D. Size pull boxes and junction boxes to best meet the needs of the particular situation and/or location and to comply with the National Electrical Code.

E. Coordinate the work in this section with the work under other divisions of this specification.

END OF SECTION

SECTION 26 05 33
CONDUITS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment, and appliances required in conjunction with the installation of conduit systems as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications and product data for products to be used.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Rigid Metal Conduit: Heavy-wall, mild steel tube with metallic corrosion-resistant coating on interior and exterior, hot-dipped galvanized, free from defects and manufactured in accordance with ANSI standards, and UL listed.

B. PVC Coated Rigid Metal Conduit:

1. Hot dip galvanized inside and out. Factory-cut threads shall be protected with hot galvanized threads and a clear urethane coating. Thread protectors shall be used on the exposed threads. The PVC coating must have been investigated by UL as providing the primary corrosion protection for the rigid galvanized steel conduit. The PVC coating shall be gray, 40 mils in thickness, continuous over the entire length of the conduit except at the threads, and be free of blisters, bubbles, or pinholes and manufactured in accordance with UL 6 Standard for Safety, Rigid Metal Conduit.

C. Electric Metallic Tubing (EMT): Welded steel tubing formed of low carbon steel, electro-galvanized exterior, inside coated with a thick, baked, tough elastic low-friction coating of enamel, and UL approved.

D. Intermediate Metal Conduit (IMC): Manufactured in accordance with UL 1242 with interior coating of silicone epoxy ester lubricant.

E. Flexible Metal Conduit: Single strip helically wound interlocking galvanized steel, UL listed; provide liquid tight with extruded polyvinyl jacket in damp and wet locations and in kitchens.

F. Rigid Nonmetallic Conduit:

1. Direct buried - Schedule 40, UL listed.
2. Concrete encased - Schedule 20, UL listed.

G. Elbows and Bends:

1. Rigid nonmetallic conduit systems - PVC coated rigid metal conduit.
2. Other conduit systems - same material as the conduit with which they are installed.

H. Bushings:

1. 1-1/4 in. and smaller - high-impact thermosetting phenolic insulation, 150°C, O-Z/Gedney Type A.
2. 1-1/2 in. and larger - hot-dipped galvanized with thermosetting phenolic insulation, 150°C, O-Z/Gedney Type B.

I. Locknuts:

1. 1-1/4 in. and smaller - zinc-plated heavy stock steel, O-Z/Gedney.
2. 1-1/2 in. and larger - cadmium-plated malleable iron, O-Z/Gedney.

J. Hubs: Cadmium-plated malleable iron, tapered threads, neoprene 'O' ring, insulated throat, O-Z/Gedney.

K. EMT Connectors: Compression type, zinc-plated steel body, cadmium-plated malleable iron nut, insulated throat, O-Z/Gedney.

L. EMT Couplings: Compression type, zinc-plated steel body, O-Z/Gedney.

M. Liquid tight 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. Through-Wall and Floor Seals: Malleable iron body, oversize sleeves, sealing rings, pressure clamps and hex-head cap screws, O-Z/Gedney Type FSK.

O. End Bells: Hot-dipped galvanized, threaded, malleable iron, O-Z/Gedney Type TNS.

P. Expansion Fittings: Hot-dipped galvanized, malleable iron with bonding jumpers.
   1. Linear - O-Z/Gedney Type AX or TX.
   2. Linear with deflection - O-Z/Gedney Type AXDX.

Q. Escutcheons: Chrome-plated sectional floor and ceiling plates, Crane No. 10.

R. Accessories: Reducers, bushings, washers, etc., shall be cadmium-plated, malleable iron of the forms and dimensions best suited for the application.

S. Identifying Tape for Buried Conduits: 6 in. wide, polyethylene, with printing continuous along length of tape, Brady Identoline.
   1. For buried electric power conduits- red with black letters.
   2. For buried electric communication conduits - orange with black letters.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Size conduits as indicated on the Contract Drawings and as required by the National Electrical Code for the quantity and sizes of wires to be installed in the conduit. Do not use conduit sized less than 1/4 in. unless specified otherwise.

B. No more than one, three-phase circuit or three, single phase circuits may be placed in a single conduit, unless specifically noted on the drawings as such.

C. Conceal conduits from view in all areas except mechanical and electrical rooms and crawl spaces. Should it appear necessary to expose any conduit:
   1. Bring it to the attention of the Architect immediately and obtain Architect’s approval for location of exposed conduit.
   2. Rearrange the work to facilitate an approved installation.
   3. Exposed conduit shall be painted with color as selected by the Architect.

D. Install conduits at elevations to maintain headroom and at locations to avoid interference with other work requiring grading of piping, the structure, finished ceiling, walls, access panels, etc. Avoid crossing other work.

E. To prevent displacement, securely support conduits to be concealed in the building structure and installed in advance of other work. Carefully lay out conduits installed within the structure, such as floors, beams, and walls to avoid densities excessive for the construction.

F. Install 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 in. concrete cover except where penetration into the slab is made. Do not install conduit larger than 1 in. in slabs.

G. Ream, remove burrs, and swab inside conduits before pulling in conductors.

H. Cap or plug conduits with standard manufactured accessories as soon as the conduits have been permanently installed in place.

I. Make bends and offsets in 1 in. and smaller conduits with approved bending devices. Do not install conduits, which have had their walls crushed, deformed or their surface finish damaged due to bending.

J. Where space conditions prohibit the use of standard ells, elbows, and conduits, use cast ferrous alloy fittings of such forms and dimensions as best suited for the application.

K. Make conduit joints mechanically tight, electrically continuous, and watertight. Pitch conduits in areas where moisture may subsequently be present in a manner to avoid creating moisture traps; where unavoidable, provide junction box with drain fitting at conduit low point.

L. Install insulated throat threaded hubs on conduits entering enclosures without threaded hubs in wet and damp locations.

M. Install and neatly rack exposed conduits parallel with and perpendicular to building walls. Provide space for 25% additional conduit. Do not install exposed diagonal conduit runs.

N. Route and suspend conduits crossing expansion joints to permit expansion, contraction, and deflection utilizing approved fittings to prevent damage to the building, conduits, and supporting devices.

O. Do not install conduits exposed on the roof unless approval is obtained prior to installation.

P. Route conduit through roof openings for piping and duct-work where possible; otherwise, route through roof penetration system as specified in Section 26 05 27 - SEALING OF PENETRATIONS.

Q. Do not place conduits in close proximity to equipment, systems and service lines, such as hot water supply and return lines, steam pipes, which could be detrimental to the conduit and its contents. Maintain a minimum of 3 in. separation, except in crossing, which shall be a minimum 1 in.

R. Connect motors, equipment containing motors, equipment mounted on isolated foundations, 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. Restrict length of flexible conduit to 6 ft. maximum unless specifically instructed in writing otherwise by the Architect. Provide secure supports at the points of attachment on each side of the connection. Use bonding jumpers as directed by the National Electrical Code and other sections of these specifications.

S. Install escutcheons on sight exposed conduits passing through interior floors, walls, and ceilings in finished spaces

T. Install fire seals on conduits passing through fire-rated partitions, floors and ceiling.

U. Install through-wall seals on conduits passing through exterior walls or use standard galvanized steel pipe sleeves, diameters 1/2 in. greater than the outside diameter of the sleeved conduit and fill the annular space with mastic.

V. Install sleeves for conduits passing through interior floors.

W. Install insulated throat grounding bushings on conduits stubbed through slabs and foundations into electrical enclosures.

X. Provide grounding of conduits, fittings and accessories. Refer to grounding section of specifications.

Y. Feeder Circuits:

1. Install rigid metal conduit in damp and wet locations, in concrete slabs, and where exposed in mechanical and electrical equipment rooms and crawl spaces.
2. Install flexible metal conduit where specified above and where permitted by the authorities having jurisdiction. Use liquid tight flexible metal conduit in damp and wet locations, where exposed in mechanical and electrical equipment rooms, and in kitchen and shop areas.

3. Exterior to the building and below grade, bury Schedule 80 nonmetallic conduit, where permitted by the authorities having jurisdiction. If not permitted, use rigid steel conduit in accordance with installation requirements stated below. Elbows and bends greater than 30 degrees shall be rigid steel with PVC coating or wrapped with half-lapped, 0.20 inch thick, self-sticking, anti-corrosive PVC pipe wrapping tape. Vertical extensions from the elbow to above grade or slab shall be rigid steel with PVC coating or wrapping tape.
4. Exterior to the building and above grade, use rigid steel conduit and for elbows and bends greater than 30 degrees.

Z. Branch Circuits:
1. Install rigid metal conduit in damp and wet locations, in concrete slabs, and where exposed in crawl space.
2. Install electrical metallic tubing where concealed by building structure and where exposed in mechanical and electrical equipment rooms.
3. Exterior to the building and below grade, bury Schedule 80 nonmetallic conduit, where permitted by the authorities having jurisdiction. If not permitted, use rigid steel conduit in accordance with installation requirements stated below. Elbows and bends greater than 30 degrees shall be rigid steel with PVC coating or wrapped with half-lapped, 0.20 inch thick, self-sticking, anti-corrosive PVC pipe wrapping tape. Vertical extensions from the elbow to above grade or slab shall be rigid steel with PVC coating or wrapping tape.
4. Exterior to the building and above grade, use rigid steel conduit and for elbows and bends greater than 30 degrees.
5. Install flexible metal conduit where specified above and where permitted by the authorities having jurisdiction. Use liquid tight flexible metal conduit in damp and wet locations, where exposed in mechanical and electrical equipment rooms, and in kitchen and shop areas. Limit flexible conduit to a length of 6 ft. maximum unless specifically instructed otherwise, in writing, by the Architect.

END OF SECTION

SECTION 26 05 34
OUTLET BOXES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of outlet boxes as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 - PRODUCTS

2.01 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, with 1/2 in. male fixture studs where required.

B. Cast Boxes: Cast metal, deep type, gasketed cover, threaded hubs. Use cast boxes for damp and outdoor installation.

C. Provide boxes with plaster ring where required. Boxes for installation in masonry walls shall be special square corner masonry type.

D. Furnish boxes with proper covers and device plates.

E. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain tight. Cast metal box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

2.02 FLOOR BOXES

A. Single Service (Power, data, telephone, etc.)

1. Ground level and below: round, cast iron, fully adjustable, Hubbell #B2537 with brass cover and threaded outlets #S3725 for flush outlets and #SC3099/98 series pedestal for surface receptacles. Use #SC309D for single duplex receptacle and #SC309B for back or blank face. Use SB3182 brass carpet flange in areas that have carpet.
2. Above ground level: round, galvanized steel, fully adjustable, Hubbell #B2529 with covers and fittings as described in 2.2.A.1 above.
3. Ground level and below; telephone and other communication outlets: round, cast iron, fully adjustable, Hubbell #B2536 with brass cover and threaded outlet #S2525 cover for flush outlet and #SC3099/98 series pedestal and SS309T for telephone single outlet. Use #SB3182 brass carpet flange in areas that have carpet.
4. Above ground level; telephone and other communication outlets: round, galvanized steel, fully adjustable, Hubbell #B2529 with covers and fittings described in 2.2.A.3 above.

B. Multiple Service (Power, data, telephone, etc.)

1. Rectangular, cast iron, fully adjustable with number of gangs as shown on plans, Hubbell #B4000 series with brass cover and threaded outlets #S3625. Use SB308X series brass carpet flange in areas that have carpet.

2.03 RECESSED TELEVISION OUTLET BOXES

A. Multiple Service (Power, data, cable, etc.)

1. Recessed three gang box with molded rectangular cut-out and fram. Metal mounting brackets and steel power outlet box. Frame accepts standard size wiring device coverplates, Pass & Seymour #TV3WMTVSS. Color to match wiring devices.

PART 3 - EXECUTION

3.01 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on the Drawings, and as required for splices, taps, wire pulling, equipment connections and code compliance.

B. Determine from dimensions shown on the Contract Documents and by actual measurements on the site, the exact location of each outlet. Outlet locations shall be modified from those shown on the plans to accommodate changes in door swings, space changes or to clear other interferences that arise or from job modifications. Make such modifications at no cost to the Owner as a matter of job coordination. Coordinate job conditions and notify the Architect of discrepancies before proceeding with the installation of the work. Set wall boxes in advance of wall construction blocked in place, and secure. Set wall boxes flush with the finish. Install extension sleeves as required to extend boxes to finished surfaces.

C. The locations of equipment and outlets shown on the Contract Documents are approximate. Check and verify exact locations in the field. Coordinate installation with the Architect and with the work under other divisions of the specifications.

D. Unless otherwise noted, location of outlet boxes, measured to centerline of box, shall be as follows:

	EQUIPMENT OR OUTLETS	ELEVATION
		(ABOVE FINISHED FLOOR)
	Toggle Switches	3 feet - 10 inches
	Fire Alarm Pull Stations	3 feet - 10 inches
	Receptacles	1 foot - 6 inches
	Clock and Clock Outlets	7 feet - 6 inches
	Fire Alarm Audible or Audible/Visual Devices	6 feet - 8 inches to bottom of device
	Combination motor starters	5 feet - 0 inches
	Control stations	3 feet - 10 inches
	Manual starters	5 feet - 0 inches
	Thermostats in office	3 feet - 10 inches
	Telephone/data outlets	1 foot - 6 inches
	Circuit protective devices	6 feet - 6 inches to top of enclosure

E. Locate and install boxes to allow access. Where installation is inaccessible, coordinate locations and sizes of required access doors in accordance with other sections of the specifications.

F. Locate and install to maintain headroom and to present a neat appearance.

3.02 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls. Provide a minimum 6 in. separation in common wall cavity, except provide minimum 24 in. separation in acoustic rated walls. Refer to architectural drawings for locations of acoustic walls.

B. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.

C. Provide knockout closures for unused openings.

D. Use multiple-gang boxes where multiple devices are shown to be installed together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

E. Install boxes in walls without damaging wall insulation.

F. Coordinate mounting heights and locations of outlets mounted above counters, benches and back splashes.

G. Position outlets to coordinate luminaire locations with ceilings.

H. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.

I. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

J. Align wall-mounted outlet boxes for switches, thermostats and similar devices.

END OF SECTION

SECTION 26 05 35
WIREWAY

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of wireway systems as indicated in the Contract Requirements.

1.02 SUBMITTALS

A. Submit copies of manufacturer's specifications for products used.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide wireway as manufactured by Square D, Hoffman, B-Line or accepted substitute.

B. General-purpose wireway: Square D Square Duct Series LD.

C. Wireway end closures, supports and associated fittings: Square D, of best forms and dimensions for applications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide systems of wireway of sufficient size where indicated. Provide for equipment racks or cabinets mounted in close proximity.

B. Size wireway cross-sectional area and length based upon conductor fill and equipment served as required by the NEC and local codes.

C. Install types based on environmental conditions to which exposed.

D. Coordinate the work in this section with the work under other divisions of this specification.

END OF SECTION

SECTION 26 09 24
OCCUPANCY SENSORS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

B. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 26.

C. Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, and building control systems.

1.02 SYSTEM DESCRIPTION

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically within 30 minutes when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The suppliers obligation shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

1.03 SUBMITTALS

A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.

B. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor.

C. Submit any interconnection diagrams per major subsystem showing proper wiring.

D. Submit standard catalog literature that includes performance specifications indicating compliance to the specification.

PART 2 - SPECIFIC REQUIREMENTS

2.01 ACCEPTABLE MANUFACTURERS

A. The Watt Stopper.

B. Leviton.

C. Hubbell-My Tech-UNENCO.

D. Approved equivalent.

2.02 PRODUCTS

A. Leviton product numbers:

1. Ceiling mounted dual technology (infrared & ultrasonic) sensors: OSC series, area coverage as required by application.
2. Wall mounted dual technology (infrared & ultrasonic) sensors: OSSMT series.
3. Wall mounted passive infrared sensors: ODS series.
4. Power Packs: OSP series.

B. All sensors shall be capable of operating normally with any electronic ballast, PL lamp systems and rated motor loads.

C. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

D. All sensors shall have readily accessible, user adjustable controls for time delay and sensitivity. Controls shall be recessed to limit tampering. The maximum selectable time delay setting shall not exceed 30 minutes.

E. In the event of failure, a bypass manual 'override on' shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

F. Ultrasonic operating frequency shall be crystal controlled to within plus or minus 0.005% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

G. All sensors shall provide a method of indication to verify that motion is being detected during testing and that the unit is working.

H. All sensors shall have no leakage current to load, in manual or in Auto/Off mode, for safety purposes during testing and shall have voltage drop protection.

I. All sensors shall have UL rated, 94V-0 plastic enclosures.

2.03 CIRCUIT CONTROL HARDWARE - CU

A. Externally mount through a 1/2 in. knockout on a standard electrical enclosure or fixture housing and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Transformer shall provide power to a minimum of two (2) sensors.

B. Relay Contacts shall have ratings of:

1. 13A - 120 VAC Tungsten
2. 20A - 120 VAC Ballast
3. 20A - 277 VAC Ballast

2.04 CONTROL WIRING

A. Control wiring between sensors and controls units shall be Class II , 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable approved for use in plenums, where applicable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. It shall be the contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors if shown on the drawings are diagrammatic and indicate only the rooms to be provided with sensors. The contractor shall provide additional sensors as required to properly and completely cover the respective room.

B. Do not install sensors within 24 inches of HVAC system air devices.

C. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.

D. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

END OF SECTION

SECTION 26 09 27
LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Provide all labor, materials, supervision, tools, services, equipment and incidentals necessary for a complete and operational lighting control system as specified under this division and as shown on the Contract Drawings.

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

C. Where existing lighting control systems are being tied into, provide modified or additional lighting controls compatible with existing lighting control system. Where existing lighting control system is unable to be used, provide a new lighting control system with requirements noted per this specification.

1.02 SYSTEM DESCRIPTION

A. Provide a lighting control system consisting of contactor control panel(s), control switches, photocell, and other controlling devices connected by low voltage wiring. The general operation of lighting and controlled loads shall include:

1. Interior lighting: manual switch control on/off for each space with automatic time scheduled shut-off.
2. Timed on/off loads: time on, time off.
3. Exterior lighting: photocell or astronomic on/time off, time on/photocell or astronomic off.
4. Exterior security lighting: photocell or astronomic on, photocell or astronomic off.

B. Requirements are indicated elsewhere in the specifications for work including, but not limited to, raceways and electrical boxes and fitting required for installation of control equipment and wiring.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. Component Pre-testing: All components and assemblies are to be factory pre-tested prior to installation.

C. System Support: Factory applications engineers shall be available for telephone support.

D. UL Approvals: Remote panels are to be UL listed under UL 916 Energy Management Equipment.

E. FCC Emissions: All assemblies shall be in compliance with FCC emissions Standards specified in Part 15 Subpart J for Class A application.

1.04 SUBMITTALS

A. Shop Drawings: Submit dimensional drawings of all lighting control system components and accessories.

B. One Line Diagram: Submit a one-line diagram of the system configuration proposed if it differs from that illustrated in the riser diagram included in the contract drawings.

C. Typical Wiring Diagrams: Submit typical wiring diagrams for all components including, but not limited to, contactor panels, contactors, photocells, switches, occupancy sensors and daylighting controls.

1.05 MANUFACTURERS

A. The basis of the specified system is the Basic Control contactor panel manufactured by The Watt Stopper. Any other system wishing to be considered must submit descriptive information ten (10) days prior to bid. Prior approval does not guarantee final approval by the electrical engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the engineer.

PART 2 - PRODUCTS

2.01 BASIC CONTROL CONTACTOR PANELS

A. Description
   1. Basic Control contactor panels shall be UL listed and consist of the following:
      a. Tub: Empty NEMA 1 enclosure that can accept an interior sized to accept up to 16, 32, or 64 contactor poles.
      b. Cover: Surface or Flush as required, with captive screws in a hinged, lockable configuration.
      c. Interior: Metal back plate and barrier for separation of high voltage (class 1) and low voltage (class 2) wiring. Intelligence board with eight channels of control provided regardless of interior size, interiors shall be provided with up to 16, 32, or 64 DIN rail mounted contactor poles.

B. Features
   1. Contactors shall be DIN rail mounted, four pole, normally closed, electrically held with coil voltage to match panel control power voltage. Contactors shall be compatible with all lighting, ballast and HID loads and be rated for 20 Amp tungsten up to 277V and rated for 30 Amp ballast and general use up to 600V. Provide 20% spare contactor poles.
   2. Eight automatic control channels for operating contactors controlling exterior and/or interior lighting. Each channel shall be individually configurable to meet project needs. Each channel shall include an LED light status indicator to provide channel status and a separate ON/OFF/Auto switch for manual channel control.
   3. Clock port for connection to the system clock. The system clock shall have eight override inputs to provide logic control of the eight channels from external photocells, switches, occupancy sensors, timers, daylighting controllers, etc.
   4. Expansion terminals shall be provided for low voltage wiring connection between main and expansion panels in a multiple panel system. All automatic channel operation in the designated main panel (panel with the system clock), shall signal expansion panels' corresponding channels to operate.
   5. Auxiliary power for operating optional system devices provides 350mA at 24VDC and 350mA at 24 VAC power.

2.02 SYSTEM CLOCK

A. Description
   1. The system time clock shall be installed in the main or central panel of a multiple panel system or in each panel when individual panel time control is desired. The system clock shall provide time-based control with eight year time back-up, non-volatile memory program storage, automatic daylight savings adjustment, selectable 12/24 hour time formats and selectable date formats. All clock programming shall be accessible from the clock front display/keypad.

B. Features
   1. Control of eight control channels shall be available on the clock. Provide status and manual ON/OFF control of each channel from the front display and keypad.

2. The clock shall have control of eight individual override inputs, which can be used to connect external devices such as photocells, switches and daylighting controllers. Each of these inputs can be configured to operate as a photocell, as an ON/Auto switch, as a maintained ON/OFF switch, or as a momentary ON/OFF switch.
3. Schedules shall be assigned to any combination of days of the week and/or 3 holiday day types. Other scheduling features shall include:
    a. Temporary schedules: Schedules that execute on an assigned day then automatically delete themselves from memory.
    b. Repeating schedules: Repeat a schedule at intervals that are adjustable from 5 minutes to 10 hours.
4. 32 perpetual holidays assigned to any one of three holiday day schedules and continuing for 1 to 120 days. Holiday dates shall be specific day/month/year, or perpetual dates including day/month/all years or day of the week in a given month every year or self-calculating Easter Sunday.
5. Astronomic capability for calculating sunrise and sunset based on time, latitude, longitude, and time zones. All scheduled astronomic/time operations shall be interlocked so loads are not turned on when astronomic off times are earlier than scheduled on times or astronomic on times are later than scheduled off times. Each schedule shall have an independent astronomic offset of ± 120 minutes.
6. Following a power outage, the system clock shall run a start-up process that executes schedules that would have been missed during the power outage.

2.03 AUTOMATIC CONTROL SWITCHES

A. Description
    1. Automatic control switches shall be push button wall switches capable of ON/OFF manual operation and shall also be capable of receiving automatic control signals through interrupting power to the circuit feeding the switch and load. The automatic control switch shall mount in a standard single gang or multi-gang wall box and shall fit behind a decorator style faceplate.

B. Features
    1. The automatic control switch shall use an air gap relay rated for 20 Amp ballast, tungsten, general use, and 1hp motor rating. It shall be compatible with all electronic ballasts and motor loads, and utilize self-adjusting zero cross switching technology.
    2. Multiple operating modes/features selectable by using switch push button and configuration LEDs. Setting operating modes/features shall not require removal of switch faceplate. Switch settings shall include: occupancy sensor mode, audible beep, command ON feature.
    3. Lighting control panel operation shall include the capability of automatically shutting switches off, turning switches on, and delaying switches off.
    4. Delay OFF operation shall provide a one-two second warning blink followed by a five-minute delay time period before shutting off the lights. During the delay OFF period, the locator LED shall blink and, if enabled, an audible warning beep shall sound each minute for the first four minutes and each five seconds during the last minute of the delay time period. The delayed shut off may be canceled by pressing the front push button. After a lighting control panel OFF command, the locator LED light will illuminate.
    5. Each switch shall operate in single, 3-way, 4-way or multi-way applications and provide full switch functionality from each switch location.

2.04 EXTERIOR PHOTOCELL

A. Description

1. The exterior photocell shall offer a footcandle range of 1-15 and an eight-second time delay. The photocell shall mount on the exterior or roof of a building with its light level window facing the northern sky. The photocell shall provide an ON signal when the ambient light level drops below a user-defined setpoint, and an OFF signal when the ambient light level rises above a user-defined light setpoint.

B. Features
   1. The photocell shall use a set of normally open, isolated relay contacts that are rated for one Amp at 30 VAC/VDC.
   2. The photocell shall have an adjustable ON/OFF dark setpoint.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Automatic control switches and/or photocells shall be mounted as indicated on the drawings. All wiring shall be labeled clearly indicating which contactor panel it connects to. Use only properly color-coded, stranded wire per manufacturer's recommendations. All channels and switches shall be tested after installation to confirm proper operation, and all connected loads shall be recorded on the contactor schedule for each panel.

B. The contactor panels shall be mounted in electrical closets as indicated on the drawings. The contactors shall be wired to control the power of each load as indicated on the lighting control schedules included in the drawings. All power wiring will be identified with the circuit breaker number controlling the load. If multiple circuit breaker panels are feeding into a control panel, wires shall clearly indicate the originating panel's designation.

3.02 OPERATIONS AND MAINTENANCE MANUAL

A. Contractor shall provide system documentation after the equipment has been installed:
   1. Lighting control panel schedule
   2. Lighting channel schedule
   3. System Clock schedule
   4. System Installation and Operation Manual shipped with Basic Control contactor panel and System Clock shall be provided to the owner.

3.03 SYSTEM STARTUP

A. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all system components.

3.04 TRAINING

A. Manufacturer shall provide factory authorized application engineer to train owner personnel in the operation and programming of the lighting control system.

3.05 WARRANTY

A. Manufacturer shall provide a one year warranty for all system components.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Refer to Section 26 28 16 - OVERCURRENT PROTECTIVE DEVICES.

C. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of panelboards as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturers' specifications for products used.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Panelboards shall consist of a box, front, interior and circuit protective devices and shall be manufactured in accordance with NEMA standards and bear applicable UL labels.

B. The box shall be fabricated of code gauge galvanized sheet steel in accordance with UL standards, and shall have turned edges around the front for rigidity and for clamping on front. Provide standard knockouts on panel enclosure. Fabricate the front from sheet steel and finish with baked on gray enamel over a rust inhibitor. Each front shall have a door mounted on semi-concealed hinges with a cylinder lock, index card and cardholder. For dry indoor installation cover shall be door in door type (hinged door and continuous hinged cover). All panelboard locks shall be master keyed and all index cards shall be properly completed on a typewriter. Furnish two keys for each panelboard.

C. The interiors shall consist of a factory-assembled rigid frame supporting the rectangular bus, the mains and the neutral bar. The busing shall be arranged for sequence phasing throughout. Bus bar shall be sized to limit the temperature rise in accordance with NEMA standards. The insulated neutral bar shall be located at the opposite end of the structure from the mains. Panelboards shall have either solderless lugs or a main circuit protective device as scheduled. Each enclosure shall be provided with grounding lugs and uninsulated equipment grounding terminals.

D. Busing shall be tin plated aluminum attached for sequence phasing throughout.

E. Panelboards shall be single-phase, three wire or three-phase, four-wire as scheduled or as required. Panelboards shall contain sequence style busing and full capacity neutral, composed of an assembly of bolt-in-place molded case automatic air circuit breakers with thermal and magnetic trip and trip free position separate from either "on" and "off" positions. Provide circuit breakers that simultaneously open all poles on double and three-pole circuit breakers. Provide panelboard and circuit breaker interrupting capacities and ratings equivalent to or greater than the fault current available to each panelboard and as shown on the Drawings. Series rating shall not be used in determining interrupting rating of panelboards. Single-pole circuit breakers serving fluorescent lighting loads shall carry the SWD marking. Circuit breakers serving high intensity discharge lighting loads shall carry the HID marking.

F. Where required by local or national code, ordinance or other authority, provide NEMA 3R enclosures where located in rooms with fire protection sprinklers. Further, if required by local or national code, ordinance or other authority, provide shields from sprinklers in working clearance in front of panelboards where panelboards are in rooms with fire protection sprinklers. Shields shall be constructed with same gauge metal as panelboard enclosure and shall have the same finish as panelboard enclosure.

G. Where installed on building exterior or in Kitchen spaces, provide painted NEMA 4X stainless stee.

H. Voltage rating, phase, number of wires and ampere rating shall be as shown and scheduled in the Contract Documents.

I. Approved manufacturers: Eaton (Cutler Hammer), General Electric (ABB), Siemens, or Square D.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install a panelboard at each location shown on the Drawings.

B. Each panel shall have a circuit index located on the inside of the cabinet door. This index shall have each circuit identified, including spares and spaces. The identification index shall be typewritten and covered with a plastic cover.

C. The various branch circuits served from the panelboards vary in loading. Carefully balance the load on each phase when connecting the various branch circuits in each panelboard. When all load is turned on and the system is operating a 100 percent demand, the initial unbalance shall not exceed 10 percent.

D. Refer to Section 262716 regarding spare conduit requirements at flush-mounted panelboard cabinets and additional cabinet requirements.

E. Refer to Section 26 05 10 regarding labeling requirements for panelboards.

F. Coordinate the work under this section with the work under other divisions of the specifications.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Provide labor, materials, services, equipment and appliances required in conjunction with the installation of wiring devices as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used. Manufacturer's catalog numbers listed are used to set the standard.

B. Acceptable Manufacturers: Hubbell, Leviton and Pass & Seymour. All wiring devices for the project shall be of one manufacturer.

PART 2 - PRODUCTS

2.01 SWITCHES

A. Single pole, 15 amp
   1. Hubbell HBL1201; Leviton 1201-2; Pass & Seymour PS15AC1

B. Double pole, 15 amp
   1. Hubbell HBL1202; Leviton 1202-2; Pass & Seymour PS15AC2

C. Three way, 15 amp
   1. Hubbell HBL1203; Leviton 1203-2; Pass & Seymour PS15AC3

D. Four way, 15 amp
   1. Hubbell HBL1204; Leviton 1204-2; Pass & Seymour PS15AC4

E. Single pole, 20 amp
   1. Hubbell HBL1221; Leviton 1221-2; Pass & Seymour PS20AC1

F. Double pole, 20 amp
   1. Hubbell HBL1222; Leviton 1222-2; Pass & Seymour PS20AC2

G. Three way, 20 amp
   1. Hubbell HBL1223; Leviton 1223-2; Pass & Seymour PS20AC3

H. Four way, 20 amp
   1. Hubbell HBL1224; Leviton 1224-2; Pass & Seymour PS20AC4

I. Key switches - Hubbell 1221RKL; Leviton 1221-2KL; Pass & Seymour PS20AC1KL series, with two keys. Prong keys will not be acceptable.

J. Provide 20 amp switches for loads exceeding 10 amps.

K. Use HP rated switches approved for motor control or disconnect service when controlling or disconnecting motor loads in excess of 1/4 HP.

L. Door switch on when door is open, equivalent to Pass & Seymour 1200.

M. Door switch on when door is closed, equivalent to Pass & Seymour 1201.

N. Switch with pilot light, equivalent to Hubbell 1221PL with red polycarbonate toggle.

2.02 RECEPTACLES

A. Simplex receptacle, 15 amp
   1. Hubbell HBL5261; Leviton 5261; Pass & Seymour 5261

B. Simplex receptacle, 20 amp
   1. Hubbell HBL5361; Leviton 5361; Pass & Seymour 5361

C. Duplex receptacle, 15 amp
   1. Hubbell HBL5262; Leviton 5262; Pass & Seymour PS5262

D. Duplex receptacle, 20 amp

1. Hubbell HBL5362; Leviton 5362; Pass & Seymour PS5362

E. Duplex receptacle, 15 amp, with split circuit hot tab and one controlled face permanently marked for use with automatic outlet control systems
   1. Hubbell BR15C1; Leviton 5262-1P; Pass & Seymour 5262CH

F. Duplex receptacle, 20 amp, with split circuit hot tab and one controlled face permanently marked for use with automatic outlet control systems
   1. Hubbell BR20C1; Leviton 5362-1P; Pass & Seymour 5362CH

G. Duplex receptacle, 15 amp, with 2 Type A, 3 amp, USB jacks
   1. Hubbell USB8200; Leviton T5632; Pass & Seymour TR5262USB

H. Duplex receptacle, 20 amp, with 2 Type A, 3 amp, USB jacks
   1. Hubbell USB8300; Leviton T5832; Pass & Seymour TR5362USB

I. Duplex receptacle, 15 amp, with 2 Type C, 5 amp, USB jacks
   1. Hubbell USB15C5 or equivalent

J. Duplex receptacle, 20 amp, with 2 Type C, 5 amp, USB jacks
   1. Hubbell USB20C5 or equivalent

K. Safety or tamperproof receptacle, 15 amp
   1. Hubbell HBL5262TR; Leviton 5262-SG; Pass & Seymour TR62

L. Safety or tamperproof receptacle, 20 amp
   1. Hubbell HBL5362TR; Leviton 5362-SG; Pass & Seymour TR63

M. Ground fault circuit interrupting (GFCI), tamper resistant, type receptacle, equivalent to Hubbell GFST83W. Provide weather resistant GFCI receptacle for exterior locations. Do not use feed-through feature. Install GFCI device at each location.

N. Transient Voltage Surge Suppressor (TVSS) receptacles shall be Hubbell IG5262S, blue duplex receptacle, or equivalent, UL 1449 listed for both Category A and B tests. Receptacle shall provide a minimum of 210 joules surge protection in all three modes: hot to neutral, hot to ground and neutral to ground.

2.03 WIRING DEVICES

A. All wiring devices shall be color as selected by Architect.

2.04 COVERPLATES

A. Interior - smooth nylon equivalent to inch thick, color as selected by the Architect. Color may vary from room to room. Screw heads shall have color to match plate. Stainless steel equivalent to Leviton type 302/304 Series with Cadmium plated screws.

B. Provide telephone and data coverplates same as above, except with single bushed hole for cable. Leviton Quick-Port Wall plate insert with Quick-Port Snap-In Modules.

C. Exterior - extra heavy duty, die cast aluminum, weatherproof while-in-use cover equivalent to Hubbell WP26E series.

PART 3 - EXECUTION

3.01 COORDINATION

A. Determine from dimensions shown in the Contract Documents and by actual measurements on the site the exact location of each wiring device. The wiring device locations shall be modified from those shown on the plans to accommodate changes in door swings, space changes or to clear other interferences that arise, or from other job modifications. Make such modifications at no cost to the Owner as a matter of job coordination. Notify the Architect of discrepancies before proceeding with the installation of the work.

3.02 TAMPER RESISTANT RECEPTACLES

A. All 125 volt, 15 and 20 ampere receptacles shall be tamper resistance type where shown on the drawings and as required by NEC Article 406.12.

3.03 INSTALLATION OF WIRING DEVICES

A. Install receptacles and switches only in electrical boxes that are clean, free from excess building materials, debris, etc.

B. Switches installed at one location shall be ganged together under one coverplate.

C. Install receptacles for electric water coolers out of sight where possible.

3.04 TESTING

A. Test wiring devices to insure electrical continuity of grounding then energize circuit to demonstrate compliance with requirements.

END OF SECTION

SECTION 26 28 13
FUSES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Division 26 Basic Electrical Materials and Methods sections apply to work of this section.

1.02 SUMMARY

A. Extent of fuse work required by this section is indicated by drawings, and by requirements of this section.

B. Refer to Division 26 sections for the following items; not work of this section.

1. Panelboards.
2. Motor disconnects.

1.03 SYSTEM DESCRIPTION

A. Types of fuses specified in this section include the following:

1. Class L time-delay.
2. Class L fast acting.
3. Class RK1 time-delay.
4. Class RK1 and Class J current limiting.
5. Class RK5 time-delay.
6. Class RK5 time-delay, non-current-limiting.
7. Class H non-current-limiting.
8. Class T current limiting.

1.04 SUBMITTALS

A. Product data: Submit manufacturer’s technical product data on fuses, including specifications, electrical characteristics, installation instructions, furnished specialties and accessories. In addition, include voltages and current ratings, interrupting ratings, current limitation ratings, time-current trip characteristic curves, and mounting requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of fuses of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Codes and Standards:

1. UL Compliance and Labeling: Comply with applicable provisions of UL 198D, “High-Interrupting-Capacity Class K Fuses”. Provide over current protective devices that are UL-Listed and labeled.
2. NEC Compliance: Comply with NEC as possible to construction and installation of fusible devices.
3. ANSI Compliance: Comply with applicable requirements of ANSI C97.1 “Low Voltage Cartridge Fuses 600 Volts or Less”.

1.06 MAINTENANCE

A. Maintenance Stock, Fuses: For types and ratings required, furnish additional fuses, amounting to one unit for every 5 installed units, but not less than one set of 3 of each kind.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fusible devices which may be incorporated in the work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide fuses of one of the following:
   1. Bussmann Division, Cooper Industries
   2. Littelfuse, Inc.
   3. Mersen

2.02 FUSES

A. General: Except as otherwise indicated, provide fuses of types, sizes, ratings, and average time-current and peak let-through current characteristics indicated, which comply with manufacturer's standard design, materials, and constructed in accordance with published product information, and with industry standards and configurations.

B. Class L Time-Delay Fuses: Provide UL Class L time-delay fuses rated 600-volts, 60Hz, with 200,000 RMS symmetrical interrupting current rating for protecting transformers, motors, and circuit breakers.

C. Class L Fast-Acting Fuses: Provide UL Class L fast-acting fuses rated 600-volts, 60Hz, with 200,000 RMS symmetrical interrupting current rating for protective service entrances and main feeder circuit breakers.

D. Class RK1 Time-Delay Fuses: Provide UL Class RK1 time-delay fuses rated 600-volts, 60 Hz, with 200,000 RMS symmetrical interrupting current rating for protecting motors and circuit-breakers

E. Class RK1 Current-Limiting Fuses: Provide UL Class RK1 current-limiting fuses rated 250-volts, 60Hz, with 200,000 RMS symmetrical interrupting current rating for protecting circuit breakers.

F. Class J Current-Limiting Fuses: Provide UL Class J current-limiting fuses rated 600-volts, 60Hz, with 200,000 RMS symmetrical interrupting current rating.

G. Class RK5 Time-Delay Fuses: Provide UL Class RK5 time-delay fuses rated 600-volts, 60 Hz,

H. Class K5 One-Time Fuses: Provide UL Class K5 one-time fuses rated 250-volts, 60Hz, with 100,000 RMS symmetrical interrupting current rating for protecting non-inductive loads.

I. Class H Fuses: Provide UL Class H fuses rated 600-volts, 60Hz, with 10,000 RMS symmetrical interrupting current rating, for protecting general purpose light duly feeders.

J. Class T Fuses: Provide UL Class T fuses rated 600-volts, 60Hz, with 200,000 RMS symmetrical interrupting current rating for protection of physically small devices.

2.03 CABLE LIMITERS

A. Cable Limiters: Provide cable limiters rated 600-volts, 60Hz, 400 amperes with tubular type terminals for compression connection to 500 MCM copper cable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which fuses are to be installed, and notify Engineer in writing of conditions detrimental to proper completion of work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

3.02 INSTALLATION OF FUSES

A. Install fuses as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC, and NEMA standards for installation of fuses.

B. Coordinate with other work, including electrical wiring, as necessary, to interface installation of fuses with other work.

C. Install fuses in fused switches, where shown on plans.

3.03 FIELD QUALITY CONTROL

A. Prior to energization of fusible devices, test devices for continuity of circuitry and for short-circuits. Replace malfunctioning units with new units, and then demonstrate compliance with requirements.

END OF SECTION

SECTION 26 28 16
OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment appliances required in conjunction with installation of overcurrent protective devices as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 - PRODUCTS

2.01 FUSES

A. Fuses shall be current-limiting, with 200,000 RMS symmetrical amperes interrupting rating and shall be UL listed. All fuses shall be of same manufacturer.

B. Fuses over 600 amperes shall be Class L, bolt-on type, with time-delay and hold 500 percent rated fuse current for minimum of 4 seconds and clear 20 times rated fuse current in .01 seconds or less. Fuses shall have 'O' ring seals between end bells and glass melamine barrel, equivalent to Bussmann time delay KRP-C.

C. Fuses 600 amperes and smaller shall be Class RK1, dual element. These fuses shall have separated overload and short-circuit elements. The overload, time-delay element shall be spring activated and utilize a eutectic alloy with a 284-degree F. melting point. The fuse shall hold 500 percent of its rated fuse current for a minimum of 10 seconds, equivalent to Bussmann dual-element LPN-RK (250 volts or less rating) and LPS-RK (600 volts or less rating).

D. Fuses in motor circuits shall be changed, if necessary, as follows: Fuses for not less than 1.15 service factor motors shall have an ampere rating 125 percent of motor full load current or next higher fuse rating. Fuses for 1.0 service factor motors shall have an ampere rating 115 percent of motor full load current or next higher fuse rating. Use special fusing sizing considerations where motors are subjected to high ambient temperatures, where the motor drives an inertia load causing starting current to be prolonged, where on-off cycles less than 30 minutes, or where special hermetically sealed motors have unusual starting characteristics. When a physically smaller fuse is required in a switch, then the fuse clips must be changed.

E. Ballast controlled light fixtures shall have fuses installed on the line side of the ballast when indicated. The fixture manufacturer shall size fuses, Bussman GLR fuses and HLR fuse holder or equivalent for indoor installation.

2.02 MOLDED CASE CIRCUIT BREAKERS

A. Molded Case Circuit Breaker Characteristics – General

1. Circuit breakers shall be constructed using glass reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
2. Circuit breakers shall have an over center, trip free, toggle operating mechanism which will provide quick-make, quick-break contact action. The circuit breaker shall have common tripping of all poles.
3. The circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breaker escutcheon shall be clearly marked ON and OFF in addition to providing International I/O markings.
4. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker.

5. Circuit breakers shall be equipped with UL Listed electrical accessories as noted in these specifications. Circuit breaker handle accessories shall provide provisions for locking handle in the ON and OFF position.
6. All circuit breakers shall be UL Listed for reverse connection without restrictive line and load markings and be suitable for mounting in any position.
7. Circuit breakers shall be equipped with factory installed mechanical lugs. All circuit breakers shall be UL Listed to accept field installable/removable mechanical type lugs (except Square D type Q2, Q2H and Q2-H or equivalent). Lug body shall be bolted in place; snap in design not acceptable. All lugs shall be UL Listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors . Lugs shall be suitable for 90°C rated wire, sized according to the 75°C temperature rating in the National Electrical Code. Provide lugs as required to accept feeder conductor sizes and quantities as shown on drawings.
8. All circuit breakers shall be capable of accepting bus connections.
9. All circuit breakers 400A and above shall be 100% continuous current rated, with electronic trip (shunt trip) and LSIG.
10. Circuit breakers shall be fully rated and capable of interrupting the fault current available to them. Series connected ratings with upstream devices is not acceptable to meet this requirement.
11. Manufacturer shall provide electronic and hard copy time/current characteristic trip curves (and lp & I^2t let through curves for current limiting circuit breakers) for each type of circuit breaker.

B. Thermal-Magnetic Circuit Breakers
1. Circuit breakers shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
2. Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true RMS sensing and thermally responsive to protect circuit conductor(s) in a 40°C ambient temperature.
3. Circuit breaker frame sizes above 100 amperes shall have a single magnetic trip adjustment located on the front of the circuit breaker except type Square D, Q2, Q2H and Q2-H or equivalent.
4. Standard two- and three-pole circuit breakers up to 250 amperes at 600 VAC shall be UL Listed as HACR type.

C. Electronic Trip Circuit Breakers With Standard Function Trip System
1. Circuit breaker trip system shall be a microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the drawings.
2. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.
3. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and adjustment positions shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously.
4. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.
    a. Long Time Pickup Instantaneous Pickup
    b. Long Time Delay Ground Fault Pickup

c. Short Time Pickup Ground Fault Delay (I^2t OUT only)
d. Short Time Delay (I^2t IN only)

5. A means to seal the trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
6. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
7. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in true RMS with 2% accuracy.
8. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.
9. The trip system shall include a Long Time memory circuit to sum the time increments of intermittent overcurrent conditions above the pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
10. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.

D. Electronic Trip Circuit Breaker With Full Function Trip System

1. Circuit breaker trip system shall be a microprocessor-based true rms sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedules.
2. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.
3. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously.
4. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent of all other adjustments.
   a. Long Time Pickup Instantaneous Pickup
   b. Long Time Delay Ground Fault Alarm Only Pickup
   c. Short Time Pickup Ground Fault Pickup
   d. Short Time Delay (I^2t IN and I^2t OUT) Ground Fault Delay (I^2t IN and I^2t OUT)
5. Circuit breakers with adjustable short-time function shall be provided with defeatable instantaneous adjustment and 30 cycles short time withstand ratings. Short time withstand ratings shall be specified in RMS symmetrical amperes, as shown on the drawings.
6. A means to seal the rating plug and trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
7. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
8. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in True RMS with 2% accuracy.

9. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.
10. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
11. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.
12. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.
13. Circuit breakers shall be provided with Zone Selective Interlocking (ZSI) communications capabilities on the short-time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems .

E. Insulated Case Circuit Breaker With Full Function Trip System
1. Circuit breaker shall be Fixed, Individually Mounted construction.
2. Circuit breaker trip system shall be a microprocessor-based true RMS sensing design with sensing accuracy through the thirteenth (13th) harmonic. Sensor ampere ratings shall be as indicated on the associated schedules.
3. The integral trip system shall be independent of any external power source and shall contain no less than industrial grade electronic components.
4. Circuit breakers shall be equipped with back-up thermal and magnetic trip system.
5. The ampere rating of the circuit breaker shall be determined by the combination of an interchangeable rating plug, the sensor size and the long-time pickup adjustment on the circuit breaker. The sensor size, rating plug and switch adjustments shall be clearly marked on the face of the circuit breaker. Circuit breakers shall be UL Listed to carry 100% of their ampere rating continuously.
6. The following time/current response adjustments shall be provided. Each adjustment shall have discrete settings and shall be independent from all other adjustments.
    a. Long Time Pickup Instantaneous Pickup
    b. Long Time Delay Ground Fault Alarm Only Pickup
    c. Short Time Pickup Ground Fault Pickup
    d. Short Time Delay (I^2t IN and I^2t OUT) Ground Fault Delay (I^2t IN and I^2t OUT)
7. Circuit breakers with adjustable short-time function shall be provided with defeatable instantaneous adjustment and 30 cycles short time withstand ratings. Short time withstand ratings shall be specified in RMS symmetrical amperes, as shown on the drawings.
8. A means to seal the rating plug and trip unit adjustments in accordance with NEC Section 240-6(b) shall be provided.
9. Local visual trip indication for overload, short circuit and ground fault trip occurrences shall be provided.
10. An ammeter to individually display all phase currents flowing through the circuit breaker shall be provided. Indication of inherent ground fault current flowing in the system shall be provided on circuit breakers with integral ground fault protection. All current values shall be displayed in True RMS with 2% accuracy.
11. Long Time Pickup indication to signal when loading approaches or exceeds the adjusted ampere rating of the circuit breaker shall be provided.

12. The trip system shall include a Long Time memory circuit to protect against intermittent overcurrent conditions above the long time pickup point. Means shall be provided to reset Long Time memory circuit during primary injection testing.
13. Circuit breaker trip system shall be equipped with an externally accessible test port for use with a Universal Test Set. Disassembly of the circuit breaker shall not be required for testing. Test set shall be capable of verifying the operation of all trip functions with or without tripping the circuit breaker.
14. Communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information shall be provided.
15. Circuit breakers shall be provided with Zone Selective Interlocking (ZSI) communications capabilities on the short time and ground fault functions compatible with all other electronic trip circuit breakers and external ground fault sensing systems as noted on drawings.
16. True two-step stored energy mechanism with five (5) cycle closing time shall be provided. All circuit breakers shall have multiple CHARGE/CLOSE provisions allowing the following sequence:
    a. CHARGE CLOSE RECHARGE OPEN/CLOSE/OPEN
17. Local control pushbuttons to OPEN and CLOSE circuit breaker shall be provided. Color-coded visual indication of contact position (OPEN or CLOSED) shall be provided on the face of the circuit breaker. Local manual charging following CLOSE operation shall be provided. Color-coded visual indication of mechanism CHARGED and DISCHARGED position shall be provided on the face of the circuit breaker. Visual indicator shall indicate CHARGED only when closing springs are completely charged.
18. Each circuit breaker shall be electrically operated to permit remote CHARGE, CLOSE, and OPEN capabilities. Electrically operated circuit breaker shall be equipped with charge contact switch for remote indication of mechanism charge status.
19. All circuit breakers shall be equipped with electrical accessories as noted on schedules.
20. Provide the following interlocking capabilities:
    a. Cell door interlock
    b. Key interlock for main-tie-main
    c. Lock off

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install overcurrent devices in accordance with the National Electrical Code. Coordinate the work under this section with the work under other divisions of the specifications.

B. Do not share neutral conductors between circuits protected by arc fault circuit interrupters.

C. Fuses shall be installed in all switches as scheduled or noted on the Drawings, and shall be Bussman, Mersen, Littelfuse, Inc., or an approved equivalent.

D. Unless otherwise indicated, protective devices shall be mounted with top of cabinet or enclosure 6 ft. 6 in. above finished floor, properly aligned, and adequately supported independently of the connecting raceways. All steel shapes, etc., necessary for the support of the equipment shall be furnished and installed where the building structure is not suitable for mounting the equipment directly thereon.

END OF SECTION

SECTION 26 28 17
DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with installation of disconnect switches as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Furnish fusible Class 'R' or non-fusible disconnect switches of ampere rating as required, or as indicated on the Drawings. Furnish heavy-duty, quick-make, quick-break, three-phase, three-pole switches, unless otherwise noted. Use NEMA 1 enclosures where installed indoors. Use NEMA 3R for outdoor enclosures. Use NEMA 4X enclosures where installed in all Kitchen areas. Provide enclosures with interlocking covers, externally front operated flange mounted switch levers, and provisions for use of three safety padlocks in the 'Off' position. Provide horsepower rated switches for motor circuits.

B. Approved manufacturers: Eaton (Cutler Hammer), General Electric (ABB), Siemens, or Square D.

PART 3 - EXECUTION

3.01 INSTALLATION

A. See Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK paragraph: Identification of Electrical Equipment.

B. Install switches to comply with National Electrical Code and coordinate the work with the work under other divisions of the specifications.

END OF SECTION

SECTION 26 29 13
MOTORS, MOTOR STARTERS AND CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with installation of motors, motor starters and controls as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products to be used.

1.03 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT

A. Electrical wiring for mechanical equipment is separated into two main wiring Divisions: "Power Wiring" and "Control Wiring".

B. Power wiring is wiring and conduit from the primary energy source and includes circuit protective devices, motor starters or controllers, conduit, wiring and safety disconnects beginning at the power supply and terminating at the motor terminals on equipment.

C. Control wiring is wiring and conduit not included in "Power Wiring", including automatic temperature control wiring, interlock wiring, pilot light, signal wiring, etc., that is included for proper operation or safety of the equipment.

D. Provide power wiring under Division 26 of this specification.

E. Control wiring will be provided under Division 23 of this specification.

F. Refer to Section 26 05 12 - MECHANICAL AND ELECTRICAL COORDINATION, for directions concerning coordination of the work between Divisions 23 and 26. Coordinate the work under this section with the work under other divisions of the specifications.

G. Install power and control wiring in compliance with National Electrical Code and this Division.

H. Disconnect switches, except where furnished factory mounted, shall be supplied and installed by the Electrical Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Unless otherwise specified or required, control conductors with a potential of 120 volts or higher shall be a minimum of #14 THWN stranded, and control conductors with a potential of less than 120 volts may be #16 TFFN, unless larger conductors are required to compensate for voltage drop.

B. Install control wiring in a separate conduit raceway system.

C. Color code conductors to coordinate with wiring schematics and diagrams.

D. Other materials shall be as specified in other sections of the specifications.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Note that the electrical design and drawings are based upon equipment furnished under other divisions of the specifications as indicated in the Contract Documents. Should any equipment change dictate changes to the electrical design the required changes shall be made at no additional cost to the Owner.

B. Verify the electrical capacities of all motors and electrical equipment furnished by other Divisions and install wiring and equipment as required to completely connect all equipment.

C. Where possible, terminate conduits in conduit boxes on motors. Where motors are not provided with conduit boxes, terminate the conduits in condulet fittings at the motors.

D. Where disconnect switches are not provided integral with the control equipment for motors, provide disconnect switches required by these Specifications and the NEC. Generally, disconnect switches shall be heavy-duty, enclosed, externally operable, horsepower-rated switches. Each disconnect switch shall be installed where shown on the Drawings or as close as possible to the motor. Each disconnect switch shall be within sight of its associated controller.

3.02 OVERCURRENT PROTECTION

A. Prior to providing power to equipment, obtain manufacturer's engineering and electrical data.

B. Provide overcurrent protection of equipment in strict accordance with manufacturer's maximum recommendations and specifications. Provide HACR circuit breakers and fuses in accordance with manufacturer's recommendations and specifications.

C. Install wiring in a separate conduit raceway system in harmony with other raceway systems on the project.

D. Install starters, not furnished within a motor control center on a 3/4 in. thick marine plywood backboard painted to match the surrounding area. Apply a minimum of two coats of paint. Install control and/or accessory devices on the backboard also, in mechanical equipment areas.

3.03 ELECTRICAL CONNECTIONS

A. Provide electrical connections to each item of equipment requiring such connections.

3.04 EQUIPMENT IDENTIFICATION

A. Identify starters, switches, pushbuttons and other control devices by the attachment of nameplates constructed from laminated phenolic engraved plastic three-ply with black surface and white interior core at least 1/16 in. thick. Engraved lettering shall use an Arial bold font at least 1/4 in. high and properly spaced for legible and easy reading. Attach plates to equipment with chromium-plated screws. Adhesive attachment is not acceptable.

END OF SECTION

SECTION 26 29 16
CONNECTIONS TO KITCHEN EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of connections to kitchen equipment as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Product Data: Manufacturer's brochures giving specifications, ratings, application, installation instructions, and finishes.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide waterproof wiring and materials as specified in other sections of these specifications and as required by the manufacturer of equipment furnished.

B. Provide shunt-trip circuit breaker provision for all equipment installed under a hood containing dry chemical fire protection. Connect the shunt-trip circuit breaker(s) to the dry chemical fire protection system(s).

C. All kitchen equipment provided with receptacles shall be GFCI protected. Panelboard manufacturer shall be capable of providing GFCI Circuit Breakers, no exceptions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Do not use Contract Drawings for construction. Obtain rough-in data and wiring requirements from manufacturer for each piece of equipment to be installed.

B. Provide wiring for equipment in compliance with manufacturer's requirements.

C. Determine wiring required for dry chemical fire systems and provide wiring for same. Connect to fire alarm system for both annunciation and alarm.

D. Coordinate the work under this section with the work under other divisions of the specifications.

END OF SECTION

SECTION 26 43 13
SURGE PROTECTION DEVICES (SPDS)

PART 1 - GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install the Surge Protective Device (SPD) equipment having the electrical characteristics, ratings, and modifications as specified herein and as shown on the contract drawings. To maximize performance and reliability and to obtain the lowest possible let-through voltages, the ac surge protection shall be integrated into electrical distribution equipment such as switchgear, switchboards, panelboards, busway (integrated within bus plug), or motor control centers.

1.02 REFERENCES

A. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

1.03 SUBMITTALS

A. The following information shall be submitted:
   1. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL) or other Nationally Recognized Testing Laboratory (NRTL). Compliance may be in the form of a file number that can be verified on UL's website or on any other NRTL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (In).
   2. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

B. The following additional information shall be submitted:
   1. Descriptive bulletins.
   2. Product sheets.

1.04 RECORD DOCUMENTS

A. The following information shall be submitted for record purposes:
   1. Final as-built drawings and information for items listed in Section 1.03 and shall incorporate all changes made during the manufacturing process.

1.05 QUALIFICATIONS

A. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

B. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.06 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of manufacturer's instructions shall be included with the equipment at time of shipment.

1.07 OPERATION AND MAINTENANCE MANUALS

A. Operation and maintenance manuals shall be provided with each SPD shipped.

PART 2 -PRODUCTS

2.01 MANUFACTURERS

A. Eaton (Cutler Hammer)

B. General Electric (ABB)

C. Square D (APT)

D. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features, and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety.

2.02 VOLTAGE SURGE SUPPRESSION - GENERAL

A. Electrical Requirements

1. Unit Operating Voltage - Refer to drawings for operating voltage and unit configuration.
2. Maximum Continuous Operating Voltage (MCOV) - The MCOV shall not be less than 125% of the nominal system operating voltage.
3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.
4. Protection Modes - The SPD must protect all modes of the electrical system being utilized. The required protection modes are indicated by bullets in the following table:

	Protection Modes			
Configuration	L-N	L-G	L-L	N-G
Wye	•	•	•	•
Delta	N/A	•	•	N/A
Single Split Phase	•	•	•	•
High Leg Delta	•	•	•	•

5. Nominal Discharge Current (In) - All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.
6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) - The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

Modes	208Y/120	480Y/277	500Y/347
L-N; L-G; N-G	700	1200	1500
L-L	1200	2000	3000

B. SPD Design

1. Maintenance Free Design - The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
2. Balanced Suppression Platform - The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.
3. Electrical Noise Filter - Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable to meet this specification shall not be accepted.
4. Internal Connections - No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.

5. Monitoring Diagnostics - Each SPD shall provide the following integral monitoring options:
    a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.
        1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.
        2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.
        3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.
    b. Remote Status Monitor - The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.
    c. Audible Alarm and Silence Button - The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.
    d. Surge Counter - The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.
        1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. The surge counter's memory shall not require a backup battery in order to achieve this functionality.
6. Overcurrent Protection
    a. The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.
7. Fully Integrated Component Design - All of the SPDs components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules that must be ganged together in order to achieve higher surge current ratings or other functionality shall not be accepted.
8. Safety Requirements

a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.
b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.
c. Sidemount SPDs shall be factory sealed in order to prevent access to the inside of the unit. Sidemount SPDs shall have factory installed phase, neutral, ground and remote status contact conductors factory installed and shall have a pigtail of conductors protruding outside of the enclosure for field installation.

2.03 SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity - The minimum surge current capacity the device is capable of withstanding shall be as shown in the following table:

Minimum surge current capacity based on ANSI/IEEE C62.41 location category			
Category	Application	Per Phase	Per Mode
C	Service Entrance Locations (Switchboards, Switchgear, MMC, Main Entrance)	250 kA	125 kA
B	High Exposure Roof Top Locations (Distribution Panelboards)	160 kA	80 kA
A	Branch Locations (Panelboards, MCCs, Busway)	120 kA	60 kA

C. SPD Type - all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.04 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.
1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.
2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.
3. The panelboard shall be capable of re-energizing upon removal of the SPD.
4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.

5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.
6. The SPD shall be of the same manufacturer as the panelboard.
7. The complete panelboard including the SPD shall be UL67 listed.

B. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly)
1. Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.

C. Switchgear, Switchboard, MCC and Busway Requirements
1. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.
2. The SPD shall be of the same manufacturer as the switchgear, switchboard, MCC, and busway
3. The SPD shall be factory installed inside the switchgear, switchboard, MCC, and/or bus plug at the assembly point by the original equipment manufacturer
4. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.
5. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.
6. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.
7. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.05 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:
1. NEMA 1 - Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).
2. NEMA 4 - Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure. (sidemount units only)
3. NEMA 4X - Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

PART 3 - EXECUTION

3.01 EXAMINATION

3.02 FACTORY TESTING

A. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of NEMA and UL standards.

3.03 INSTALLATION

A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.

3.04 WARRANTY

A. The manufacturer shall provide a full ten (10) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

END OF SECTION

SECTION 26 51 13
LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of a lighting system as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of fixture, ballast and lamp manufacturer's specifications for products used. Identify the total input watts including ballast losses for each fixture type.

B. Submit lighting facts documentation for all LED fixtures.

C. If required by Architect, submit samples of lighting fixtures for approval.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lighting Fixtures: See Schedule in Contract Documents.

B. Where fixtures are subject to moisture, provide damp location (DL) or wet location (WL) label on fixtures as required for the location.

2.02 LED FIXTURES

A. Shall be tested for adherence to IESNA LM79 standards for lumen output and depreciation.

B. Shall be tested to IESNA LM80 standards and shall be rated to deliver LM80 performance for 50,000 hours.

C. Shall be DLC (DesignLight Consortium) certified.

D. Shall be equipped with 0-10 volt dimming driver.

E. Shall carry a 5 year all-inclusive component warranty for defects.

2.03 EXIT LIGHTS

A. Furnish and install exit lights as indicated in the Contract Documents.

B. Provide single or double face unit as required for each location with arrows as required to clearly define the path of egress, whether shown on the drawings or not. Provide battery powered exit lights, for ninety minute duration, if exit lights are not served with an emergency power source.

C. Locate fixtures on the ceiling or wall as required by the Architect.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide lighting fixtures as specified and scheduled in the Contract Documents. Provide in accordance with the type designation shown in the Contract Documents. If a type designation is omitted, verify fixture selection with Architect prior to installation.

B. Check the architectural finishes, and provide fixtures with proper trim, frames, supports hangers, and other hardware as required to coordinate with proper finishes, regardless of specified or scheduled catalog number, prefixes and suffixes.

C. Coordinate with Division 23 and other divisions of the specifications to avoid conflicts between lighting fixtures, supports and fittings and mechanical equipment and other work.

D. Fixtures, which are tandem mounted and recessed in gypboard or plaster ceilings shall be yoke mounted.

E. Immediately before final inspection, clean all fixtures, inside and out, including plastics and glassware, adjust all trim to properly fit adjacent surface, replace broken or damaged parts. Lamp and test all fixtures for electrical as well as mechanical operation.

F. Provide new lamps delivered to the job in the original packing cases and sleeves.

G. Test and aim floodlights, after dark, to provide a uniform and widespread illuminated area. Direct units as indicated or instructed by Architect. Direct units to prevent objectionable glare.

3.02 EXTERIOR LIGHTING CONTROL

A. Furnish a complete exterior lighting control system as indicated in the Contract Documents with additional work as required herein.

B. Provide material and equipment to properly interface timing devices and photocells with relays and contactors as required to render a complete and satisfactory operating system.

3.03 UL LISTED CEILING ASSEMBLIES

A. Provide special mounting, enclosures, and fire saving as required by authorities having jurisdiction to maintain integrity of UL listed ceiling assemblies where applicable.

END OF SECTION

SECTION 27 05 28
EMPTY CONDUIT SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

B. Furnish all labor, materials, services, equipment and appliances required in conjunction with the installation of empty conduit systems for telephone, computer communication and other systems as indicated in the Contract Documents.

1.02 SUBMITTALS

A. Manufacturer's Data: Submit copies of manufacturer's specifications for products used.

PART 2 - PRODUCT

2.01 MATERIAL

A. Provide cabinets as specified elsewhere in the specifications. Furnish total metal unit with enclosure, hinged door, lock with two keys and installed with 3/4 in. thick plywood in back.

B. Provide 3/4 in. thick marine plywood painted with one coat of primer and two coats of latex enamel to match surroundings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide a 1 in. conduit from each telephone, data or combination telephone/data outlet to the accessible ceiling space above unless noted otherwise. Turn the conduit horizontal, provide a pull string in the conduit and a plastic bushing on the conduit end.

B. At each telephone board, install #6 copper ground wire from nearest ground bus to telephone board and leave 12 in. pigtail at telephone board.

C. Install pull wire in all empty conduits or conduit systems. Label pull wire indicating the location of the other end.

D. Quantity of bends and radius of each bend for telephone conduit system shall be in accordance with requirements as set forth by the telephone company.

E. Install junction and pull boxes in empty conduits for telephone system in accordance with telephone company requirements.

F. Coordinate the work in this section with the work under other divisions of the specifications.

END OF SECTION

SECTION 28 31 07
EXTENSION OF EXISTING FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

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

B. Provide all labor, materials, supervision, tools, services, equipment and incidentals necessary for complete and operational systems as specified under this division and as shown on the Contract Drawings. This section expands and supplements the requirements of Division 1.

C. Refer to Section 26 05 10 - GENERAL REQUIREMENTS FOR ELECTRICAL WORK.

1.02 SCOPE

A. The work covered by this section of the specifications includes the furnishing of all design, labor, equipment, materials and performances of all operations in connection with the extension of the existing addressable fire alarm system as shown on the drawings, as specified herein, and as required by City of Corpus Christi Fire Department, and the Texas Department of Licensing and Regulation Texas Accessibility Standards.

B. The complete installation shall conform to the applicable section of NFPA-72A, NFPA 71, local code requirements and National Electrical Code Article 760.

C. The work covered by this section of the specifications shall be coordinated with the related work as specified elsewhere under the project specifications.

1.03 QUALITY ASSURANCE

A. Each and all items of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriter's Laboratories, Inc. (UL), and shall bear the UL label. All control equipment shall be listed under UL Category 1076 as a single control unit. Partial listing shall NOT be acceptable.

B. Provide the Owner's Representative with:

1. Manufacturer's certificate showing materials meet or exceed the minimum requirements as specified.
2. A copy of installing company's license to sell and install fire alarm systems in the State of Texas.
3. A copy of job superintendent's license to supervise installation of fire alarm systems in the State of Texas.
4. Shop drawings and wiring diagrams with equipment counts and locations shall be submitted to the local authority for approval and signature prior to submitting to Engineer through proper channels. The shop drawings must be approved by the Engineer prior to commencing work. Room names must be shown on shop drawings.

1.04 GENERAL

A. Furnish and install a modification to the existing fire alarm system as described herein and as shown on the plans; to be wired, connected and left in first class operating condition.

PART 2 - PRODUCTS

2.01 PERIPHERAL DEVICES

A. Programmable Electronic Sounders:

1. Electronic sounders shall operate on 24 VDC nominal.
2. Electronic sounders shall be field programmable without the use of special tools, to provide slow whoop, continuous, or interrupted tones with an output sound level of at least 90 dBA measured at 10 ft. from the device.
3. Shall be flush or surface mounted as show on plans.

B. Strobe lights shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:
   1. The maximum pulse duration shall be 2/10 of one second.
   2. Strobe intensity shall meet the requirements of UL 1971.
   3. The flash rate shall meet the requirements of UL 1971.

C. Audible/Visual Combination Devices:
   1. Shall meet the applicable requirements of 2.01.A listed above for audibility.
   2. Shall meet the requirements of 2.01.B listed above for visibility.

D. Manual stations shall be double-action and shall be constructed of high impact, red lexan with raised white lettering and a smooth high gloss finish. To minimize nuisance alarms, activation shall require two separate and distinct actions. The first action shall require a glass front to be broken exposing the pull lever. The second action requires the operating lever to be pulled down. Once pulled down, the lever shall remain at a 90-degree angle from the front of the station to provide a visual indication of the station in alarm. Reset shall require a key common to the control panel and replacement glass window. Pull station shall be by the same manufacturer to insure compatibility.

E. Photoelectric Smoke Detector: The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

F. Duct Smoke Detectors: Duct smoke detectors shall be of the solid-state photoelectric type and shall operate on the light scattering photodiode principle. Detector construction shall be of the split type, that is, mounting base with twist--lock-detecting head. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel. Auxiliary contacts shall be provided on the duct detectors for use by the mechanical contractor for air handling unit shut down. Duct detectors and wiring to the duct detectors shall be provided by the fire alarm contractor. Mounting of the duct detectors to be by the Fire Alarm contractor in compliance with NFPA-90A. Provide a remote alarm LED indicator/key test switch for each detector.

G. Magnetic door holders shall be controlled by 24-volt fire alarm circuit.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide and install the system in accordance with the plans and specifications, all applicable codes and the manufacturer's recommendations. All wiring shall be installed in conduit and shall be in a completely separate conduit system.

B. All junction boxes shall be sprayed red and labeled “Fire Alarm”. Wiring color code shall be maintained throughout the installation.

C. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate subcontractors.

D. Provide control relays to automatically and immediately shut down all central air supply systems and systems serving means of egress in a nursing facility upon activation of the fire alarm system.

E. The Contractor shall clean all dirt and debris from the inside and outside of the fire alarm equipment after completion of installation.

F. The manufacturer's authorized representative shall provide on-site supervision of installation.

G. Notify TAMU CC Environmental Health and Safety when fire alarm system needs to go off-line for construction activities.

H. Connect electromagnetic door holders to release doors when smoke is detected by smoke detectors on either side of doors. Refer to Architectural Specification Division 08, "DOOR HARDWARE" on drawings and FIRE ALARM drawing for locations.

3.02 DURING CONSTRUCTION

A. Provide temporary system during construction as required by Owner and all governing authorities.

3.03 TESTING

A. After all modifications, the fire alarm system shall be fully tested in accordance with NFPA-72H by the contractor in the presence of the Owner's Representative and the local Fire Marshall. Upon completion of a successful test, the contractor shall so certify in writing to the Owner and general contractor.

B. Any existing device that is intended to be reused or modified shall be tested after work is complete. Any such device including smoke detectors that fail to pass the appropriate tests shall be replaced in their entirety at no additional cost to the Owner.

3.04 WARRANTY

A. The contractor shall warrant the complete system for a period of one (1) year from the date of acceptance.

END OF SECTION